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Technical Editor. C. O. BRETTELLE, M.I.E.E. *Joint Managing Director:* E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Talking Pictures.

LAST year saw the beginning of the boom which has attended the introduction of talking pictures as a commercial form of entertainment. While many of the expectations for their future, such as the entire supersession of the silent film and even of the dramatic stage, are not likely to be fulfilled, it is not unduly optimistic to hold that talking pictures provide a very important field indeed for development.

It is true that great improvement is necessary if the talking film is to become more than a temporarily popular novelty. At present it is easy to point out defects, but many of these are due only to deficiencies in technique that experience will cure. Conditions are very much more complex than with the silent film. One of the most difficult problems is that of obtaining correct acoustic values, and this introduces questions as to the design of halls to give the best effects. Possibly theatres of large seating capacity, such as are now usual, will be found unsuitable as the public becomes educated to higher standards of performance, and the ultimate solution may lie in the division of the building into a number of halls, relatively small to yield optimum results, and holding separate audiences for the one performance. The silent film had one outstanding advantage over other stage representations in that it enabled those whose hearing powers were subnormal to enjoy every part of a performance. It should be possible, however, to extend the same advantage to the talking film by minor modifications in the reproducing apparatus.

The present position is that those able to develop the talking picture have, with quite commendable commercial acumen, seized the opportunity both to gain the requisite working experience and to exploit a profitable novelty. The justification for this procedure is the remarkable advance in technical quality of production within a few months and a prospect of further improvements as a result of "trial and error." Quite a major factor in the progress of the new style of film is the human element, strive to eliminate it as we may, and the school for operators established by eight large film companies is reported to have been largely instrumental in raising the standard of performance.

The principles underlying successful talking film production are stated in a series of articles by Mr. C. M. R. BALBI, the first of which is published in this issue. Our contributor estimates that in two or three years' time some 2,000 halls will be equipped with the necessary apparatus at a cost of £20,000,000. This estimate appears to us conservative, as from another source we learn that already about 1,600 halls are wired for talking films.

There are those who deplore the large amount of time and money spent on amusement, chiefly in picture theatres. It is conceivable that there are higher forms of recreation than attending kinema performances; but it is undeniable that there are many worse.

In our view the net effect of the picture theatre has been as decidedly beneficial to society at large as it has been to our own industry in its demands for plant, electricians, and supplies of electricity.

The Future of Tramways.

IN selecting Hastings as its Congress town this year, the Tramways, Light Railways, and Transport Association made a wise choice. Those who remember the early surface contact system along the Hastings front with the troubles that accompanied it, and the subsequent conversion to the overhead trolley system of tramways with, towards the end, a track in extremely bad condition and a very noisy system altogether, cannot fail to be impressed with the remarkable change for the better that has accompanied the conversion to trolley 'buses. Not only are the vehicles extremely comfortable and well lighted, but, with the exception of the not unpleasant swish of the trolley wheels on the wires, they are noiseless and also odourless, which cannot be said of the petrol 'buses which also ply along the front and in the narrow streets of the town. The higher average speed, also, is a factor which is much appreciated by the inhabitants and visitors.

Although the improvement in Hastings due to the advent of the trolley-'bus is so marked, it provides no valid argument for the supersession of the tramways in large cities. As Mr. W. VINCENT EDWARDS points out in his notes on the change-over at Hastings, many small towns are quite unsuitable for tramways and the abolition of single tracks with their passing places cannot fail to reduce street congestion. Messrs. J. L. BURTON and H. H. ANDREWS, in their paper on the future of tramways, refer to the latest developments in car construction, which they believe will give them a long lease of life in the larger towns and also in inter-urban transport.

That is one side of the picture; the other is symbolised by the alteration in the name of the Association with a view to retaining as members engineers who have substituted petrol 'buses for tramcars on their systems; this change indicates an electrical set-back.

There is always a danger of a fashion spreading, irrespective of the merits of the case, and, while, doubtless, the petrol 'bus often offers the best solution, the case for the electrically-propelled vehicle, with or without rails, must not be allowed to go by default. The two papers read at the Congress, which is reported on a later page, provide sound statements of the electrical case.

Electrical Manufacturing in Russia.

DURING the past three or four years reports have reached us from Russia of technical agreements made between the Soviet Government and leading foreign electrical manufacturers. The aim of these agreements was to render Russia independent of foreigners in the provision of the vast amount of plant which will be required as a result of the execution of the ambitious plans for the electrification of the country.

If the latest report (dealt with elsewhere in this issue) is to be credited these arrangements are already bearing fruit. As recently as May 23rd we dealt with the manufacturing position, and now we learn that the pre-Revolution Stahlin works claims to have constructed 150,000 kW of steam turbines last year, although during the twenty years preceding the Revolution its average annual production was only 7,500 kW. In 1931-32 the works is to turn out machines up to 50,000-kW capacity and in the following year "the workmen have given an assurance that they will carry out a 1,000,000 kW programme." The Stahlin works is also said to have supplanted an English type of boiler by one of its own design claimed to be simpler and more efficient. It is now proposed that the works shall undertake the construction of the large water turbines required for the Dnieper power station.

Another works, the "Elektrosil," is also reported to be producing large turbo-generators, for steam and water-power undertakings; moreover, it claims to have obviated the necessity of importing mercury-vapour rectifiers by turning out sufficient quantities of this plant to meet Russian requirements.

In spite of this report we are inclined to the belief that Russia will offer an expanding market for electrical machinery and apparatus for some years yet, if the electrification schemes proceed according to plan. Some confirmation of this comes from the reported conclusion of an agreement between the Soviet Government and the Metropolitan-Vickers Co. by which £3,000,000 worth of orders will be placed by the Russian Trade Delegation with the company (*Manchester Guardian Commercial*, June 5th). Another report (*The Times*, June 3rd) mentions the actual signing of an agreement for £1,000,000 worth of electrical equipment.

Hot Water for the Ordinary Household.

NO one who was present at the I.M.E.A. discussion on domestic hot water could fail to observe evidence of the belief in the future of this service entertained by many eminent electrical engineers. This discussion was reported in our last issue and is followed this week by an article concerning the means adopted at Southampton for encouraging the same class of load. Mr. W. P. CONLY lays stress on the need to consider the requirements of the ordinary household. Such households must provide by far the greater part of the field for development in electrical hot-water heating as in other uses of electricity in the home.

The Contractors' Conference.

ON Wednesday next the fifth annual Conference of the Electrical Contractors' and Allied Associations opens at Llandudno, continuing on the two following days, under the presidency of Mr. H. Willoughby-Ellis.

As in previous years, business and relaxation are to be very evenly balanced. There are again only two papers, but they both deal with topics of burning interest to contractors and should secure a good reception and discussion. One is upon "The Future of Electrical Contracting," by Mr. C. H. Flower, and the other on "Specifications and their Problems," by Mr. W. Cross. The programme has been framed on similar lines to those followed on previous occasions. There is every reason to believe, therefore, that the Conference will be a success, especially if the weather is as good as it was at Bournemouth last year.

The World Power Conference.

THE second World Power Conference was opened last Sunday in the German Reichstag, when LORD DERBY, who was president of the first Conference, handed over his duties to his successor, DR. OSCAR VON MILLER.

In his address Lord Derby mentioned the creditable manner in which Germany had harmonised the desirability of conserving historic charm with the need for the efficient harnessing of the forces of nature. As we have often submitted, the two are not incompatible.

Earlier in the same day, at a luncheon given in his honour by the Chancellor of the Reich, Lord Derby referred to the co-operation of all nations in seeking the material welfare of the world, which depended largely on the development of power resources, as a factor in the promotion of international understanding. This is in entire harmony with the view expressed in our last week's leader on the Conference.

We propose giving a report of the proceedings in a subsequent issue.

I.E.E. Summer Visit to Ireland.

An account of the five-day tour of members of the Institution of Electrical Engineers in the Irish Free State and Northern Ireland, including the River Shannon hydro-electric power development plant; June 2nd to 6th.

By OUR SPECIAL COMMISSIONER.

No. 1. — *An appreciative commentary on the social aspect of the tour, and the economic and engineering features of the works inspected at Ardnacrusha and in Belfast.*

THE day after the week before! Perhaps not the very best time to record impressions, although the languor following the lilies has its delights too. Not that there was any vice about it, but roses and rapture all the way. Substitute for roses all the marvellous flora and fresh verdure of an Irish spring under blue sky, soft and balmy air irradiated by a genial sun, and you have the delightful setting of the Institution of Electrical Engineers' summer visit to Ireland. A summer meeting in the surroundings of spring, because Nature awoke this year three weeks behind the calendar.

Most of the two hundred visitors had not been to Ireland before, and, of the remainder, hardly any could claim intimate acquaintance with the country or the people. Whether members crossed the maligned sea from Glasgow, Stranraer, Liverpool, Holyhead, or Fishguard, Neptune was kind as kind could be, and extended equally urbane treatment on the return journey. Even those hardy mariners, Mr. and Mrs. H. Marryat, who dared to cross from Falmouth to Dun Laoghaire in their 50-ft. motor boat, made a perfectly smooth passage in the remarkable time of 27 hours. The Irish, by the way, spell the name of their beautiful port of entry for mails D-u-n L-a-o-g-h-a-i-r-e and pronounce it Kingstown, following the alleged method adopted with the names of certain English aristocrats.

The summer visits of the I.E.E., if they do nothing else, serve to break down long-standing fallacies, even if they do not always remove prejudices. One fallacy which, unfortunately, was responsible for keeping a number of members in England is that the sea-passage is a terrible ordeal. As a matter of fact during the summer months an uncomfortable crossing is quite exceptional. Another is that it is always raining in Ireland, and to the perpetuation of that fallacy we fear our Irish hosts contributed, by expressing daily and hourly their anxiety lest the spell of lovely weather should be broken. Hearing some of them we might be excused for carrying away intact and reinforced the conviction that the phenomenon of two fine days in succession is observed in Ireland once in a century. That was the outcome of anxiety lest the enjoyment of a single minute of our sojourn in their country should be marred by so much as a rain drop, and by no means was warranted by the meteorological facts. Irishmen should study their own rainfall statistics, now that Sir Thomas F. Purves is not at hand to tell them the story about every fourth baby being a little Chinee with which he earned the record laugh of the summer visit.

Talking about fallacies: one member was heard expressing his relief and astonishment that the Customs officials at Dun Laoghaire did not ask him in the Irish language whether or not he had anything to declare. English, or most of its varieties, and even Scotch, seemed to be understood by the Irish people encountered by the visitors. No faction fights, revolutions, or raids were observable to the naked eye, but we may have come in the wrong week. The only soldier we saw was walking with his girl in a Belfast street, and the only lethal weapons the revolvers carried by the Belfast policemen, presumably for ornamental purposes. That is not a " selling point " for tourists, and well might be abandoned, in view of the blissfully peaceful state of the country.

Nothing could have run more sweetly than the machinery upon which the visit was carried. The Committee of the Irish Centre had no previous experience of the construction and running of that machine, although the general design was made available by headquarters, and the greatest credit is due to them for their faultless achievement. It is hardly possible that the constitutional grumbler should not be included in such a large party, but even he could have found no opportunity to indulge his perverted taste. Hotels, transport, entertainments, scenery, engineering visits, weather—all were better than the most optimistic amongst us had hoped for. It is difficult indeed, looking back upon it all, to think how it could have been improved. Even the speeches were good, particularly those delivered by the chairman of the I.F.S. Electricity Supply Board and the president of the Institution after luncheon in the generating hall at the Ardnacrusha power station on the River Shannon, when the hum of the running plant forced the speakers to fall back upon pantomime. Of the spoken speeches, so to speak, we liked best those delivered by Mr. Commissioner Murphy and President Sir Thomas Purves on the first morning when we were received by the Commissioners of the City of Dublin at the Mansion House. Both of them were phrased faultlessly and with great delicacy and charm. Of the two, that of our president, being impromptu, was the more admirable.

Mr. Murphy singled out for especial mention our president, " whose achievements, as chief engineer of the British Post Office, sometimes seemed to border upon the miraculous"; Mr. T. J. Monaghan, chairman of the Irish Centre, who holds a somewhat similar position in the Free State Post Office; Sir Archibald Page, who on his visit to Ireland as president of the Institution had endeared himself to all who met him; and " the great de Ferranti, whose death we deplored as a personal loss." He said that Dublin was the first city to install the three-phase system of generation and distribution, which had become the standard for the world, on the advice of the late Robert Hammond, for many years hon. treasurer of the Institution. The Dublin undertaking had been a great credit and asset to the City under the management of Mr. L. J. Kettle, chairman for two years of the Irish Centre.

There was no " function " on the Monday evening of arrival, but everybody went to the Gresham Hotel to meet the Committee and to get acquainted with each other. It was a good idea, and the mixing machine worked well. There was music to accompany the chatter

about old times and vanished faces, and the inveterate dancers were unable to resist the temptation to gambol (*sic*) around the boundaries of the room.

On the Tuesday morning, after being received by the City Commissioners as aforesaid, we began the proper business of the visit with a very delightful drive in County Wicklow. It would be unwise to question any of the party upon their "inspection of the overhead transmission lines *en route*." Doubtless they were there.

Everyone saw the Great and Little Sugarloaf Mountains, particularly the former, because the motor-coaches insisted on climbing to within a few yards (as it seemed) of the summit, and had to halt half-way up to let the engine-cooling water unboil, while the members, urged on by their women folk, scoured the mountain side in search of the Irish lion. A fine specimen of this almost extinct animal was seen by a Highlander on the Antrim Coast Road, but could not be secured. We regret our inability to secure a photograph of the noble beast (see figs. 1 to 6).

After luncheon at the Royal Hotel, Glendalough, we set out to explore the site of the world-famous Seven Churches; for Glendalough was a centre of culture and learning at a time when England was—well, anyway, before the existence of E.D.A. If we had nothing else for which to be grateful to the organisers of the visit, we should remember for ever to think kindly of them for inviting Mr. E. M. Stephens, a noted antiquarian of the younger school, to show us the ancient glories of Glendalough. Halting, here at the foot of the beautiful Upper Lake, there within the ruined walls of a church built by St. Kevin, now at a perfect example of a plain wheeled cross, then below the mysterious Round Tower whose "tapering cylinder" of stone, 103 ft. high, has defied untold centuries and should stand as straightly symmetrical when another thousand years shall have left the gasfilled lamp as far behind as we have left the Druid's torch.

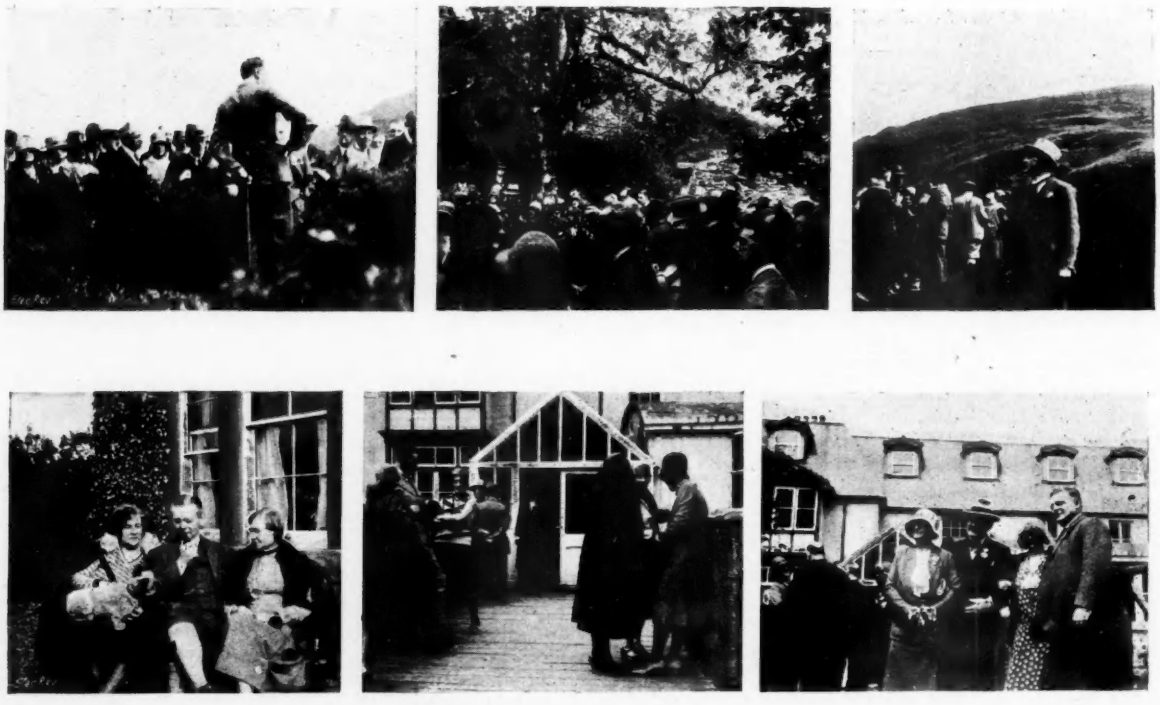
The most effective illustration of ancient Ireland's contact with one of the oldest civilisations so far discovered was the tale told by Mr. Stephens of an inscribed stone which was found near the church in which we were standing, under the blue vault of heaven. When compared with a coin of Cnossos upon which the Minoan maze was engraved, it was found that the two designs were identical. Coin and stone are displayed now at the entrance to the National Museum in Dublin. Our own theory, not yet discussed with Mr. Stevens, but now submitted for his criticism, is that the ecclesiastical foundation at Glendalough included among its cultural objectives a school of architecture and town planning, which had the honour of producing for the Cretan ruler the successful design for the famous labyrinth. Clearly the inscribed stone found at Glendalough was the office copy of the original drawing. Mr. Stephens made an ideal guide to this great centre of ancient learning, and charmed his audience with his facile interpretations of the architecture and customs of that remote period.

After tea at the hotel we were driven through the most enchanting woodland scenery back to Dublin. That night was spent in dancing in the fine ballroom of the Gresham Hotel after a reception by Sir Thomas and Lady Purves, and Mr. and Mrs. T. J. Monaghan.

On the Wednesday we travelled luxuriously and at great speed by special train to Limerick, where motor-coaches were waiting to carry us over two miles to Ardnacrusha. There we were received by Mr. R. F. Browne, chairman of the I.F.S. Electricity Supply Board; Dr. T. A. McLaughlin, managing director; and Mr. Fay, member of the Board.

Luncheon was served in the large generating hall to the accompaniment of the "purring dynamo," which presented no greater obstacle to polite conversation than the more conventional orchestra, but reduced (or elevated, it may be) the two speakers to the use of gestures admirably expressive of welcome and thanks, to the delight and satisfaction of the guests. Nevertheless, many of us were sorry that no other opportunity presented itself for Mr. Browne and Dr. McLaughlin to deliver the speeches which they had prepared for the information of the company.

Everyone knows that the development of the water power of the River Shannon by the Irish Free State has been the subject of much criticism from the earliest stages. Very rarely was that criticism free from the suspicion of prejudice arising from one or more of several causes. First in date and first in importance,



(With acknowledgments to Mr. D. S. Munro.)

Figs. 1 to 6.—Snapshots of I.E.E. Members during their Summer Tour in Ireland.

as influencing the mass mind, was the political severance, which could hardly be expected to create immediately feelings of cordial friendship between the two countries.

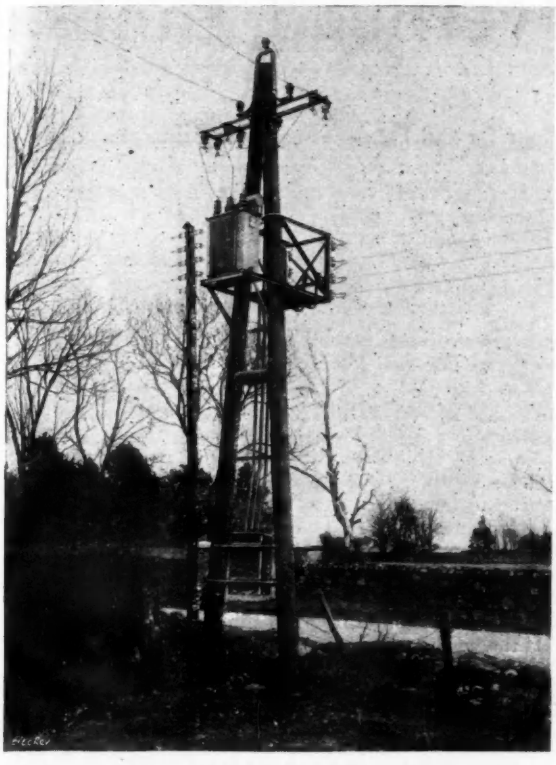


Fig. 7.—Typical 10-kV Rural Transformer Post.

In the atmosphere then prevailing the British public in mass, and British engineers in detail, were not prepared to be any more friendly in speech and in print when they heard that the Shannon scheme contract had been placed in Germany without competition. In Ireland itself the pro-British minority was hostile to the scheme for the same reasons, and the opposition was strengthened by numbers of engineers and others who were bitterly disappointed when the River Liffey power development scheme had to be abandoned by the several parties who were fighting for possession of a compact parcel of power at the gates of the capital city. On top of all that came the outcry from the City of Dublin and contiguous townships that their electrical undertakings were to be confiscated without compensation, for the purpose of merging them in the national undertaking in order to benefit the Shannon scheme.

It will be realised, therefore, that the Ministry of Industry and Commerce, which was responsible for the scheme and for the construction of the development works; and the Electricity Supply Board, which is the operating authority; have been working behind a smoke screen, not created by themselves, but directed upon them from outside. They were far too busy with the work in hand to trouble over-much about a state of mind in another country which, after all, did not seem to affect them one way or the other.

In view of the facts recited above it is to be supposed that many, perhaps most, of the members of the Institution who came to Ireland for the summer visit went to Limerick with ideas which had been conceived in an atmosphere that was not at all favourable to the undertaking. Therefore, it was particularly unfortunate that our exceedingly courteous hosts, who had put themselves to a great deal of trouble to entertain us, should have been denied the opportunity of putting the real facts of the matter before us.

The greatest scepticism has been expressed in many quarters about the possibility of so heavily capitalised an undertaking being able to pay its way.

We saw it all and could not forbear to cheer.* The power house, the head race, and the weir-intake works would be remarkable feats of engineering in any country; in a little and poor country like the Irish Free State they are veritable monuments of ambition and high courage. "Now I see where the money went," said a well-known engineer when he saw the works. Six million pounds takes some spending on electricity supply, and seeing the figures apart from the material evidence of value has been responsible for much hostile criticism hitherto. At least it may be said that a hundred English engineers whose good opinion is valuable have satisfied themselves that the Irish Free State has received delivery of the goods in full measure.

What, then, of the prospect before the Irish taxpayer? On that point the visitors as a whole probably were more dubious, mainly because they had travelled 120 miles from Dublin to Limerick through a pastoral country with little sign of human activity and found at the power station only one of the three sets running (fig. 8) and that well under half load; 11,000 kW had been touched that morning. The possible output of the first half of the station now completed is 90,000 kW and the works have been designed and partially constructed for an installed capacity of 180,000 kW.

Amongst us were people who were pleased to find that their worst hopes appeared to be realised. This German scheme was going to be a ghastly failure! No one with the initials "P. T. W." was in the party, but the letter over those initials in your issue of May 30th undoubtedly represents the attitude of mind readily acquired by others who were present. The majority was not so easily satisfied that the success or failure of this great national undertaking could be determined by reading the momentary load at midday in brilliant sunshine on June 4th, and was glad for the sake of a progressive and friendly nation that the members of the Electricity Supply Board were able to reassure one in the course of individual conversation.

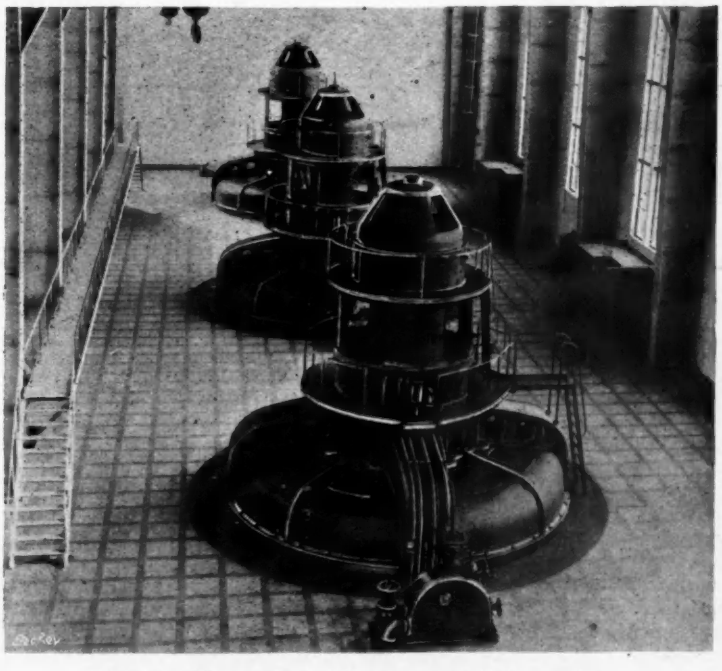


Fig. 8.—Water-wheel Alternators at Ardnacrusha.

* For illustrated description see ELEC. REV. May 9th, 16th, 23rd, and June 6th, 1930.

(To be continued.)

The Design of Overhead Lines.

Essential Constructional Features of Lines Built on the Constant-tension Principle.

By E. A. BOYD and C. BOLLAM A.M.I.E.E.

THE design of overhead transmission lines is governed by the current regulations of the Electricity Commissioners. These regulations have been formulated for securing the safety of the public, and the fundamental requirements which form the basis of the regulations may be briefly stated as follows :—

(*a*) That the materials used for the conductors, supports, &c., shall be so chosen, and the complete lines so designed, that certain minimum specified factors of safety shall be obtained against mechanical failure.

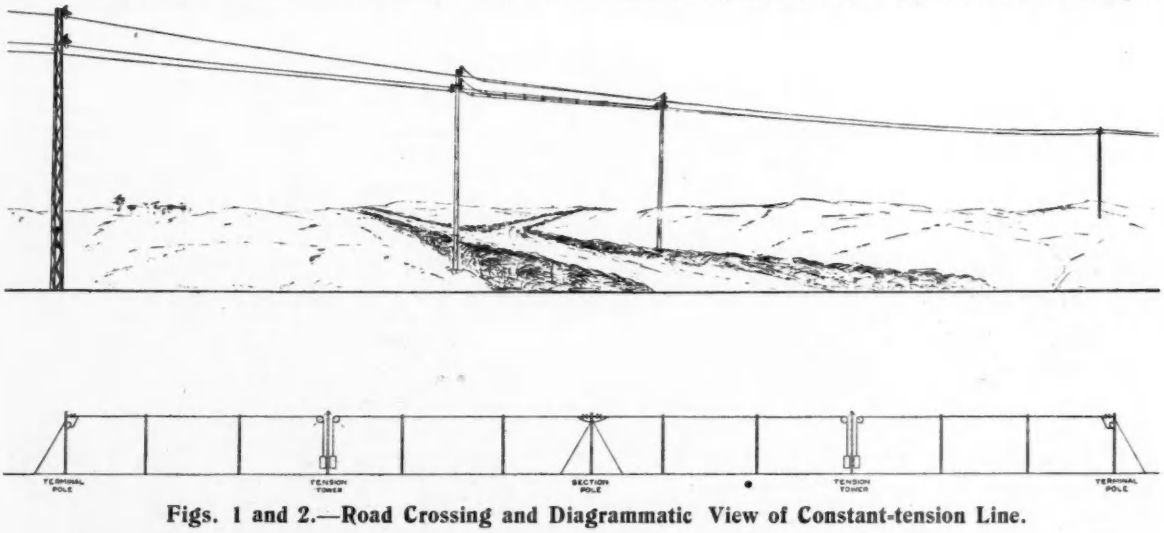
(*b*) That the charged conductors shall be so erected as to be inaccessible, and thus prevent damage to life and property.

(*c*) That in the event of the conductors breaking, insulators failing, or the supports breaking or overturning, the conductors shall be automatically discharged or made dead.

In order to give effect to the first of these basic requirements, the Commissioners have specified the minimum factors of safety against mechanical failure which shall be obtained; furthermore, they have laid down certain rules as to the method of calculating the strength of supports and conductors. The prescribed method of calculating these factors of safety involves the simultaneous application of certain specified values for wind pressure, weight and dimensions of ice loading, and limits of temperature variation. Neither of the particular specified conditions, however, can be said to represent the worst condition of either wind, ice loading, or temperature to which a transmission line is liable to be subjected, and it would appear that it is unnecessary when calculating factors of safety and clearances to employ maximum values, as it is well known that such maxima do not occur simultaneously in any particular locality in the British Isles. The prescribed limits of temperature variation, wind pressure, and ice loading have also to be considered in relation to the second basic requirement, and to give effect to this, the regulations stipulate that the charged conductors of any high-voltage line shall not, when elongated by the effects of temperature, ice loading, and wind pressure, approach nearer to the ground than 20 feet.

Although the regulations have hitherto proved effective, and do not, with the present principles of design, appear to be unduly exacting in their application, we must not lose sight of the fact that they are in the nature of a compromise, in that they are framed to cover the whole of the British Isles. Bearing this fact in mind, it is interesting to examine the result of designing lines to meet conditions obtaining in definite localities.

If there were no possibility of lines becoming ice loaded it would be a sound practice to design a line giving consideration to wind pressure and variation in temperature only, but it would obviously be prudent to employ a much higher value for wind pressure, as higher velocities would be expected in localities where snow loading is unlikely to occur. Similarly, in localities where snow loading is prevalent it would be sound practice to allow for reduced wind velocities, and to increase the snow loading factor. Thus it will be seen that it is improbable that any appreciable saving would be made in the cost of lines by amending or modifying the present regulations to meet local conditions, whilst at the same time retaining the present factors of safety.



Figs. 1 and 2.—Road Crossing and Diagrammatic View of Constant-tension Line.

Temperature variation, unlike wind and ice loading, has no appreciable effect on the stresses set up in the supports at right angles to the direction of the line; in other words, the overturning moments are not affected by temperature variation, except at angle positions. The effect of temperature is, however, an all-important factor when considering the strength of the conductors and safety of the public, as under extreme conditions the conductors may break or sag to a dangerous position.

It would therefore appear at first sight that temperature variation would offer no very hopeful field of in-

vestigation, as it is obvious that all localities are subject to considerable variations of temperature. To attempt to maintain the conductors at a constant temperature would probably be very costly, if not impracticable, and to be effective it would be necessary to maintain them at the maximum temperature likely to obtain by passing currents of varying strengths through the circuit.

It is possible, however, to eliminate the effects of temperature variation by maintaining conductors at a constant mechanical tension. A line designed on this principle will possess all the characteristics of a line which is not subject to any variation of temperature. The construction of a line on the constant-tension principle presents certain mechanical problems, particularly with regard to the tensioning device and insulated supports, but the advantages to be gained are such as to justify a departure from present designs and practice.

The essential constructional features of a constant-tension line may be described shortly as follows:—

Conductors would be rigidly attached to a terminal pole in the usual manner, but at all intermediate and angle positions they would be supported on substantially frictionless pulleys attached to the usual type of insulators, thus allowing the conductors to move freely in the direction of their length. The line would be divided into sections of convenient length and at the tensioning points the conductors would pass over pulleys and be maintained at a constant and definite tension by means of weights, which would be free to move vertically, and might be insulated from the actual conductors. A typical road crossing and a diagrammatical representation of a complete transmission line are shown in figs. 1 and 2, respectively.

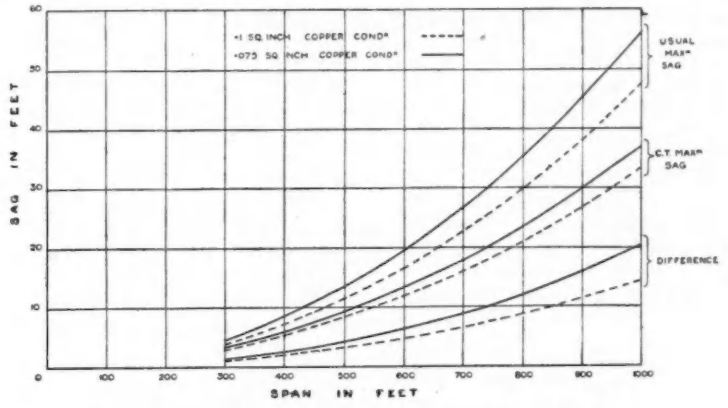


Fig. 3.—Comparison of Maximum Vertical Sags.

The following are some of the numerous advantages of such a line:—The calculations for sags and clearances will be very simple, as it may be noted that for a given span the sag will be constant throughout the range of temperature variation, and, moreover, the sag will be the same for all sizes of conductors of a given material. Ice loading, however, will produce an alteration in the sag, but the calculation of this will again be a simple matter, as the original tension will remain unaltered. All engineers concerned with the design of overhead lines will appreciate this simplification of calculation, as it is well known that with the present system of design the task of working out sag temperature and stress curves is very laborious, and inaccuracies are frequently only discovered after the line has been erected.

With the normal design of line great care has to be taken that adjacent spans are of comparable lengths, otherwise serious out-of-balance stresses will be set up at the points of support.

With a constant-tension line full advantage may be taken of salient positions and difficult wayleaves may be avoided, as adjacent spans can be varied to suit requirements.

It is obvious that, as with a constant-tension line no out-of-balance can obtain between adjacent spans, the intermediate supports will not be subject to torsional stresses, or stresses in the direction of the line. This will allow of a much cheaper type of construction, as comparatively little strength will be required in the direction of the line.

When lines have to be taken over undulating country a frequent source of trouble is experienced due to uplift at points of support. This trouble is difficult to anticipate and frequently remains undetected, as it may only occur at times of low temperature. With a constant-tension line the simplified calculations should preclude any possibility of uplift occurring; should the survey of the route have been so inaccurate as to result in uplift, the trouble will be apparent immediately the conductors are given their correct tension.

Apart from the fact, as explained above, that the supports for the constant-tension line may be considerably lighter because they are not subjected to any torsional stresses, or stresses in the direction of the line, a very considerable saving in height may be made, due to the reduced sag.

A typical instance of this saving will be clear from the consideration of a 0.1 sq. in. copper line with normal spans of 1,000 ft. The maximum vertical sag for a normal line will occur at 122 deg. F. and will be approximately 47 ft., whereas with a constant-tension line the maximum sag will occur when the conductor is ice loaded and will amount to some 33 ft. It will thus be seen that there is a saving of 14 ft. in height in favour of constant-tension line for this particular example of span and conductor. Typical sag span curves are set out in fig. 3 to show the relative sags on normal and constant-tension lines.

It may be noted here that the factors of safety prescribed by the regulations for the strength of conductors are never encroached upon under conditions of constant tension, so that it might even be considered sound practice to reduce this factor of safety for conductors to, say, 1.5 instead of the present factor of 2.

To comply with the regulations it is the usual practice to provide guarding and earthing devices at road crossings, railways, and telegraph routes; should the conductor break at such points the devices are intended to earth the broken conductor, thereby operating the automatic protective gear. These devices being only employed at special points, it is clear that, should the break occur in open country and the earth contact be indifferent, there is every possibility of the line remaining alive and becoming a grave danger to men and animals. With a constant-tension line, however, advantage may be taken of the fact that when a conductor breaks the tensioning weight falls to the ground and may be arranged to earth the broken conductor by making a definite contact with the earth plate.

Where the line crosses roads, railways, and other lines it can be supported by means of loops attached to an insulated messenger wire, thus preventing the broken conductor from falling and obstructing the traffic, or coming into contact with other lines. Furthermore, advantage may be taken of the fact that the conductor is normally at a constant definite tension to arrange that the live conductor may be disconnected from its source of supply by means of a quick-release catch set to operate as soon as the tension falls below a predetermined value.

The constant-tension principle, whilst complying in all respects with the current regulations, should be not only cheaper, but also actually safer in practice.

Designs for a line embodying the constant-tension principle have been prepared and provisionally protected, and it is hoped to erect a line in accordance therewith in England during the present year.

A Supply Engineer's Reflections.

Concerning Omnibus Tariffs, De-rating, and the Cheapening of Small Installations.

By W. E. ROGERS, A.M.I.E.E.

MY first actual experience of a two-part tariff was the operation of the telephone system. Though theoretically much is to be said in favour of this system, it much too costly to justify its wide adoption. Of all the omnibus or two-part tariffs in force to-day, probably the most universal and deservedly popular one is the "Norwich scale," more popularly known as the "ratable value system." It is deservedly popular because it is couched in everyday terms more or less comprehended by householders and tenants, but it is fundamentally and inherently unsound, as it has no bearing on or connection with the capital invested in or by the local supply authority, and it ignores running costs and the total cost of production. It is also at variance with the general principle laid down by the "Seventh Schedule" of the Electricity (Supply) Act of 1926, whilst, generally speaking, all sides admit that ratable-value assessments and the total rates vary astonishingly in any one town or district. Now, however, the De-rating Bill has become an Act, and we are in duty bound to accept it, without the usual alternative being available. Even the most ardent sponsors of de-rating admit that, at least temporarily for a period of five years, ratable values of house property are likely to be increased, and there is evidence in the quinquennial revaluation now sweeping many boroughs and districts that there a fight is proceeding between the local rating authorities and the Government Department concerned as to how much the local authority can put on the local house tenants and occupants to compensate for the loss incurred on premises and undertakings coming genuinely within the field of relief as defined in the De-rating Act of 1929. If the programmes of the two conflicting parties be placed in the mataphorical scales it is fairly obvious that "John Citizen" is once more going to pay in every sense of the word, which will mean a serious blow to the ratable-value system. It must, therefore, largely militate against the all-electric home, which so many of us are constantly being urged to "put our money on."

With regard to the cheapening of the small home installation, from time to time certain devices have come to my notice with regard thereto. The ink was hardly dry on the 9th edition of the I.E.E. rules, or, to give them their correct title, the Rules and Regulations for the Electrical Equipment of Buildings, when it became obvious to anyone in close touch with the "man with the tools" that what had been generally known as a slip-tube job, which had served a very useful purpose, had become completely out of date and must be regarded as obsolete. From a safety point of view I submit that wherever there is a plug point or any other means by which metal appliances are intended to be connected to the mains, then the whole installation should be carried out in three-core tough-rubber-sheathed cable. Personally, I have not encountered anything better than what is known as cab-tire-sheathed conductor as marketed by the original patentees of that substance, provided always that the third conductor of a three-core cable be strictly confined to the duty of providing an effective earth wire, with half the cross-sectional area of its current-carrying sisters. So far as I know only one make of tough-rubber-covered cable has been standardised to the above 3-core specification. In the manner indicated we should have a continuous earth wire throughout the installation, which should emanate approximately adjacent to the point of entry or supply. Commonly one finds on a slip-tube job a conglomeration of tubes, meters, and possibly iron-clad safety devices mounted on an ordinary meter board, and quite frequently an entirely ineffective and costly attempt at earthing. Comparatively recently in public and in the Press I drew attention to a new type of plywood meter-board which has been allocated patent protection. The gear-carrying side of this new board is faced with a metal shroud to which all casings of the apparatus on the board must of necessity be in direct contact. The face of the board also carries a substantial common earth terminal for the reception of the main protected earthing conductor, which should be directly and effectively earthed.

So far as I know it only remains for a manufacturing house with facilities for mass production to acquire manufacturing rights in order that the board may be put on the market.

How often, as soon as an installation is completed and connected, does the owner remark that he wishes he had had just one extra point installed at such and such a position, but that he is not now going to incur additional expense and disturbance? Well, recently Manchester brains have successfully, in my opinion, surmounted the difficulty by placing a novel and effective type of two-way lampholder on the market. Imagine the modern insulated type of Home Office lampholder with a side entry for a two-pin plug between the primary terminals and the lamp plungers. The plug has one of its two pins equipped with an insulating segment, so that by the simple expedient of reversing the plug pins an "off" position is secured. The plug itself has a very adequate type of cord-grip, so it readily becomes possible to have two flexible cords emanating from one pair of primary terminals, both in parallel, without the customary disadvantage of the frail plungers having to carry the total current. The side-entry plug referred to always has its pins under spring compression, without the latter having to carry any current, as distinct from the spring equipment of the primary lampholder plungers.

Co-operation in Mines Research.

The British Government recently proposed to the Belgian Government that a scheme of co-operation in mines safety research, similar to that which was arranged in 1928 between this country and France, should operate between Great Britain and Belgium. This proposal has been accepted, and arrangements are being made for a full interchange of information acquired by safety research in the two countries, including unpublished as well as published reports. A similar arrangement has recently been concluded between Belgium and France, and the circle of co-operation between the three countries is therefore complete. Full co-operation in mines safety research has been effective for the past six or seven years between Great Britain and the United States of America.

Talking Pictures.—I.

The principles of recording and reproduction, with comments on the respective features and advantages of the "Vitaphone" (disk) and "Movietone" (film) systems, both recognised to be among the leading ones in use to-day.

By C. M. R. BALBI, A.M.I.E.E., A.C.G.I.

THE year 1929 marked the advent of the practical talking picture, bringing with it a new field in engineering. It is expected that in two or three years' time at least 2,000 kinema halls in this country will be equipped with talking-picture apparatus, involving an estimated expenditure of over £20,000,000;

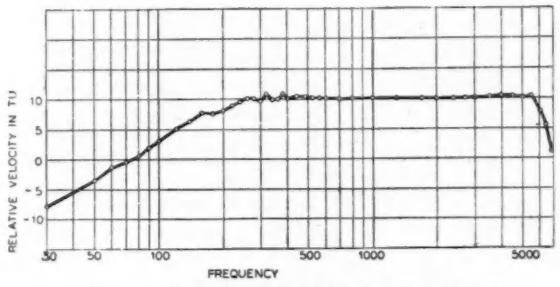


Fig. 1.—Commercial Recorder Frequency Characteristic.

similar progress is being made all over Europe and of course in the United States of America.

It is not suggested that there is anything new in the idea of talking pictures, because such things were working successfully in this country before the 1914-18 war, and inventors have been working on the subject for over forty years, but several important developments have recently taken place in connection with this subject, such as electrical recording, loud-speakers, the photo-electric cell, synchronising devices, and the light-recording tube, all of which have had an important bearing on the improvement of sound reproduction, which has made the problem of the talking picture a practical one.

General Considerations.

Since certain features are closely related to the principles involved in gramophone and wireless engineering and so much is known about those two subjects, subsequent observations will deal principally with such features as are not connected with them.

In any kinematograph system there are two distinct operations: recording and reproducing, which is also the case of any sound-recording system. The prime object of any talking-picture system is to so combine the two that the effect of movement and sound shall resemble the original when reproduced, which calls for synchronisation.

The synchronisation of a kinema film and a gramophone disk record is not difficult. Mechanical gears of a suitable ratio can easily be devised to perform the required task, but the necessity of having a disk in conjunction with the film has led inventors to try to dispense with the disk and to make a sound record on the film itself, so as to obtain a self-contained record.

So far back as 1887, Edison made a combined picture and sound record; it consisted of a series of microscopic pictures adjacent to the sound groove in a phonograph cylinder. With the aid of a microscope and a stethoscope one person at a time could view and hear the talking picture. Obviously such an arrangement could be only regarded in the light of an interesting novelty, and it was not until 1906 that Mr. Lauste, an Englishman, filed his master patent which foretold with uncanny accuracy every important feature in the talking-picture industry of to-day.

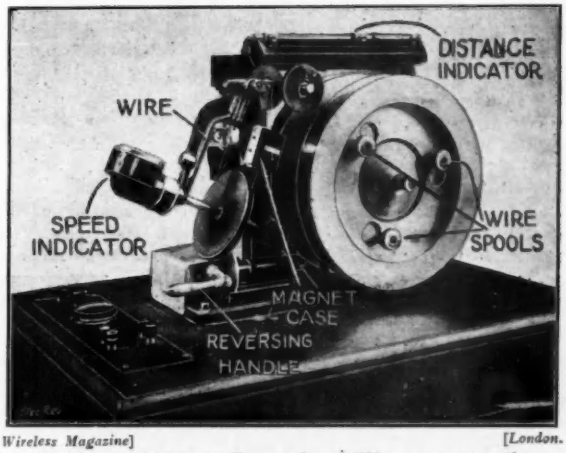
Talking-picture Systems.

Gramophone disk and photographic film records are now the two principal methods employed, certain schools favouring the first and others the second. The two systems may be exemplified in the "Vitaphone" (disk recording) and the "Movietone" (film recording) systems, both produced by the Western Electric Co., Ltd., and these two recording systems are recognised as being the leading ones. The British Acoustic Film Co.'s system is also a film method, and the original system had many interesting features which differ from the "Movietone" system.[1]

Relative Advantages of Disk and Film.

As a preliminary step it is of assistance to discuss the advantages and disadvantages of the two systems from as wide a point of view as possible.

(1) The advantage of having the sound record actually printed on the film is a considerable one, as the two cannot get separated. As can well be understood, a missing disk would completely spoil the reproduction of a talkie film, while a wrong disk would probably be the cause of much laughter, but little credit to the system; such mishaps could not happen with a sound-film record.



Wireless Magazine [London.

Fig. 2.—Modern Example of Electro-magnetic Wire Recorder.

(2) The necessity of having to transfer additional equipment in the form of records from one kinema hall to another is also a considerable disadvantage from the point of view of transport, possibility of breakage, &c., which does not occur with a sound-film record system.

[1] See also B.T.H. Co.'s system, ELEC. REV., March 14th, 1930, page 490.

(3) The amount of sound that can be recorded on a single disk is limited (*a*) by the diameter that a gramophone disk can be conveniently made, and (*b*) the bother of changing over from one disk to another while reproduction is in progress, which is considerable.

(4) With disk recording, an attempt is made to arrange the length of a scene as a multiple of the playing time of the records used. If a mistake occurs in a

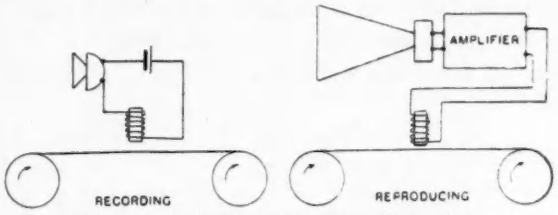


Fig. 3.—Diagram of Wire Recorder.

" shot " it is usual to repeat the performance rather than fake the record; hence, from this aspect, long records are undesirable. With film records there is no such limitation.

Joining-up Records.

The editing of disk records can be done to a limited extent in talkie reproduction by a process known as " dubbing." A new record is made from an old record, or number of records, through the medium of an electrical pick-up, change-over switches, and a key in the circuit; for instance, it would be quite possible to introduce a musical item in place of a speech into the reproduced actions of a speaker, but one could not introduce a new speech with success because of synchronisation considerations. With a sound film " cutting " is simple by comparison, as it is only necessary to print a new negative sound record on to the positive film.

Hence, everything so far is in favour of the sound-film record, but so far comparison has been made mainly from the user's point of view. The engineer's point of view has also to be considered, and in this case conflicting aspects present themselves.

Sound, or noise, other than what is intended for reproduction must be avoided, and with the ultra-sensitive microphones employed for this work it is essential to keep the faintest scratch, or rustle, to the absolute minimum, otherwise such noise will be super-imposed upon the reproduction. Because of this fact it is necessary to reduce all mechanical gearing to the minimum on account of the noise it may create, and for this reason it is not practical to combine the recording disk with the camera; apart from the fact that it would make the studio recording apparatus most cubersome, some form of electrical drive has to be arranged to turn the recorder, which can be situated in a position remote from the camera, which, in practice, is quite a difficult matter. Stopping and starting is most difficult and, owing to inertia, a disk record has to be made in one continuous run; there is no running off of little bits at a time as can be done in the case of a dictaphone. A cutting needle cannot be started on a record at any point without a speed lag and at present there is no way of overcoming it. Lastly, in practice it has been found that disk-record speed has to be controlled within closer limits than that of a film record.

With the sound film the recorder and camera can be combined without any such disadvantages, as the apparatus is neither bulky nor does it involve any additional gearing. This fact, again, indicates the superiority of the sound film over the disk record. What then are the points in its favour which make for the continuance of the disk record?

The chief reason is the high standard the disk record has attained in the way of reproduction. The difficulties of making these records have been overcome by years of experience, while the developing and printing of film records is quite a new art. Unexpected difficulties, such as " bromide noises," film shrinkage, &c., have to be contended with. When a sound film of " a silence " is taken the reproduction may not be silent on account of the " shadow of chemicals " that have not been properly washed out of the film; they are called " bromide noises."

The second reason is that in the case of the ordinary disk record electro-reproduction is comparatively simple and familiar, while the proper functioning of light-sensitive cells and their associated equipment requires a far higher level of technical ability to manipulate with the same success.

Those, then, are the chief pros and cons to consider in a talking-picture system.

Recording and Reproducing.

All forms of sound recording and reproducing are of interest to the talking-picture engineer, but only three main methods are at present known :—

(1) Those common to the gramophone disk method.
(2) Recording electrically on a steel wire.
(3) Recording by light on a sensitised film.

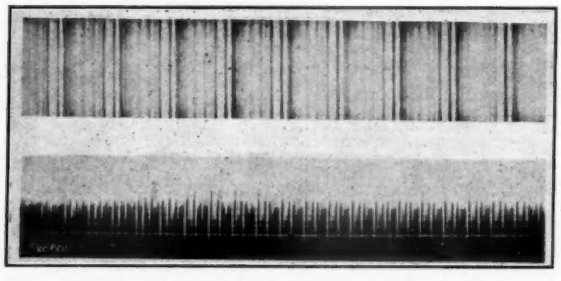
Disk recording, as has already been stated, is recognised as satisfactory for talking pictures. Electrical recording is well known and the faithfulness of high-quality reproduction from 30 to 8,000 cycles per second with a condenser-type microphone and high-quality amplifier has been well appreciated, although the wax cutter has presented difficulties which have required much ingenuity to overcome. A diagram showing the frequency characteristic of a commercial recorder is reproduced in fig. 1, in terms of output; it shows that the frequency range from 30 to 5,000 cycles can now be reproduced from a record with practically negligible distortion. The response, it is true, begins to fall below 250 cycles, but that falling characteristic is necessary in order that the maximum loudness may be obtained from a record with a given spacing between grooves without cutting over from groove to groove.

The safe maximum amplitude for a disk record is about 0.002 in. If it occurs at 250 cycles, the corresponding amplitude at 5,000 cycles, assuming the same constant intensity of sound, would be 0.0001 in. The necessity for reducing the amplitude of the cut for frequencies below 250 cycles can be compensated for in the design of the pick-up, so practically perfect reproduction can be obtained.

A more detailed description of the procedure of recording and reproducing in the " Vitaphone " system will be given later on under that heading, but no further description is required of disk recording, for the reasons already stated.

Wire recording electro-magnetically, or, in other words, impressing the magnetic variations of a modulated current on a moving steel wire, is attributed to Professor Poulsen.

The method is of great simplicity and fine reproduction can be obtained. Fig. 2 is a modern example, but the system has not come into use for talking pictures for certain reasons. For example, the magnetic vari-



Top : Constant width and varying density.
Bottom : Constant density and varying width.

Figs. 4A & B.—Photographic Sound Records.

ation on the wire tends to weaken after a comparatively short amount of use. Also, the magnetism stored in the wire is subject to destruction by magnetic variation from stray magnetic fields, whilst the making of copies is not as easy as it is with disk and light methods.

The principle will be evident from fig. 3. The apparatus shown takes a springy steel wire of 30 gauge, which is made to travel at a speed of about 1 yard per second past an electro-magnet through which a microphonic

current is made to pass; the latter induces permanent magnetism in the steel wire according to the microphonic variations sent through the electro-magnet, so that a very

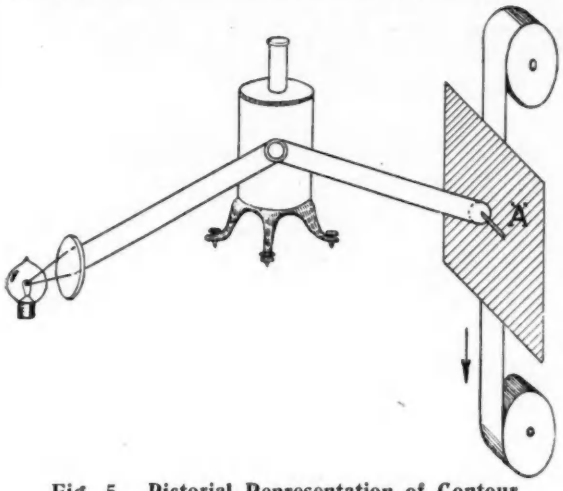


Fig. 5.—Pictorial Representation of Contour Recording.

long record can be contained in a very small space. The wire is immediately ready for recording, which is accomplished by running the wire through similar apparatus, in which the magnetic record induces a fluctuating current that can be amplified and connected to a loud-

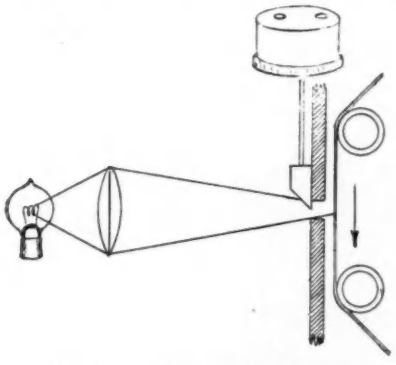


Fig. 6.—Light Density Recording; Shutter Method.

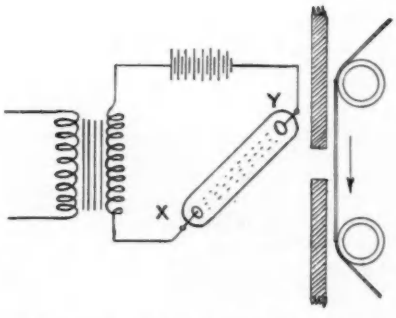


Fig. 7.—Light Density Recording; Gas-tube Method.

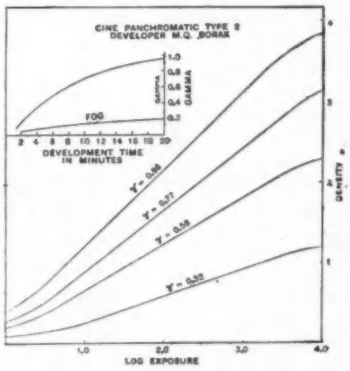


Fig 8.—Hurter Driffield Curves.

speaker. In spite of these advantages, no one seems yet to have thought them of sufficient importance to apply them to talking pictures.

Light recording methods employed are divided into (i) the contour and (ii) the density methods, examples of which are shown in figs. 4A and 4B, respectively.

The contour method (adopted chiefly by the British Acoustic Co.) shows an actual oscillogram of the sound wave record; no sound would be represented by a field 50 per cent. black and 50 per cent. white. The effect is obtained by means of a beam of light reflected on to the film by an oscillograph, whioh is acted upon by the microphonic currents received, as pictorially represented in fig. 5. When recording takes place the film is run across a fine slit " A " horizontal to the direction of travel of the film, while the reflected beam from the oscillograph marks the impressed voltage to be recorded on the sensitised film at that instant.[2]

When the film is developed a modulated contour is produced, such as is seen in fig. 4A. To obtain a sound reproduction from such a film, the contour is passed in front of another fine slit with constant illumination at the back of it, so that the amount of light passing through the slit is varied by the width unobscured by the transparent part of the film and is registered on a light-sensitive photo-electric, or selenium, cell. The light fluctuations will cause electrical reproduction to be produced from the cell corresponding to the original sound, provided that the linear speed of the film is the same as when the recording was taking place.

The oscillograph is the chief feature that presents difficulty in this particular system. The vibrator of the oscillograph has to be so constructed as to be robust, but it must have a very small mass to which can be applied a high mechanical tension and a moderate amount of damping. In the case of an oscillograph constructed by the Western Electric Co. for this purpose, that relation has been adjusted to give a result between amplitude A and phase lag B (fig. 9). From those results it can fairly be stated that the recording should be of a high accuracy.

For the density method (as used particularly in the " Movietone " system) two classes of instrument are employed to produce the same effect, *viz.*, a system whose transmitted light is varied in accordance with the impressed voltage. One system consists of a shutter which opens and closes according to the sound variations and thus admits varying amounts of light from a constant source (see fig. 6), and the other method consists of a so-called vacuum tube to which is introduced a small amount of mercury vapour, or rare gas such as neon, which becomes luminous on the application of a high potential; when a modulated output is applied across the electrodes X and Y (see fig. 7) the luminosity of the tube increases and decreases accordingly, the effect being registered on the film.

When either of those systems is placed in front of a slit behind which a sensitised film is moving, the density of the film as it passes will be affected by the amount of light admitted. Differences, or changes, in intensity of sound are represented by differences in the density of the record, while pitch is represented by the number of changes from dark to light and back again in a given length of film. When the latter is developed such an effect as is shown in fig. 4B is seen. The exposure of the

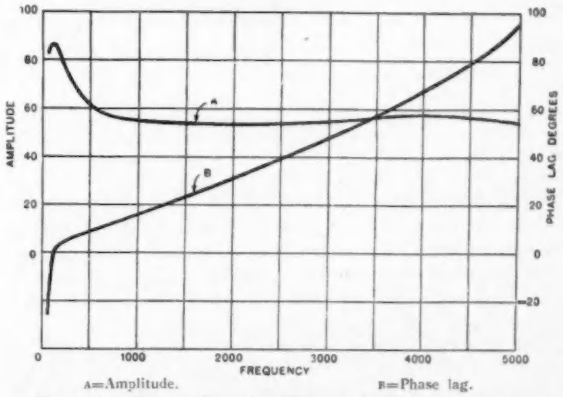


Fig. 9.—Recording Oscillograph Characteristics.

negative must be kept with the straight line of the Hurter-Driffield curve for the emulsion chosen (see fig. 8), which can be done in several ways; for instance, in the case of the light valve the illumination of the light source can be varied to give the required limits.

[2] In order to overcome patent difficulties, the light-sensitive material is sometimes made in the form of a fine strip, so as to avoid the use of an optical slit.

Ruskin Water-power Scheme.

An account of the 188,000-h.p. plant being constructed in Western Canada for the British Columbia Electric Railway Company.

By F. H. FULLERTON.

(*Concluded from page* 1097.)

The generators in the power house will be among the largest, in dimensions, on the North American continent. The generator for the first unit is now on order from the Canadian Westinghouse Company, and is a 44,000-kVA vertical-shaft set of a diameter of 33 feet. The total height from the bottom of the draft tube to the top of the unit will be just under 65 feet. The rotor portion of the generator will be 27 feet 6 inches in diameter. The weight of the revolving portion will be 550,000 lb., and the total weight of the whole unit will be 800,000 lb. The second generator to be installed later will be similar to that now ordered. The vertical reaction-type Francis turbine will be furnished by the Dominion Engineering Works, Montreal. The total weight of this unit will be 590,000 lb., and the weight of the revolving portions 97,000 lb. The weight of the rotating parts of the generator and turbine together with the hydraulic thrust will be close to one million lb., which must be sustained by a single-thrust bearing, revolving at a speed of 120 r.p.m.

The weight of each of the four step-up transformers will be 86,500 lb., and they will have a diameter of over eight feet, and a height of 19.4 inches.

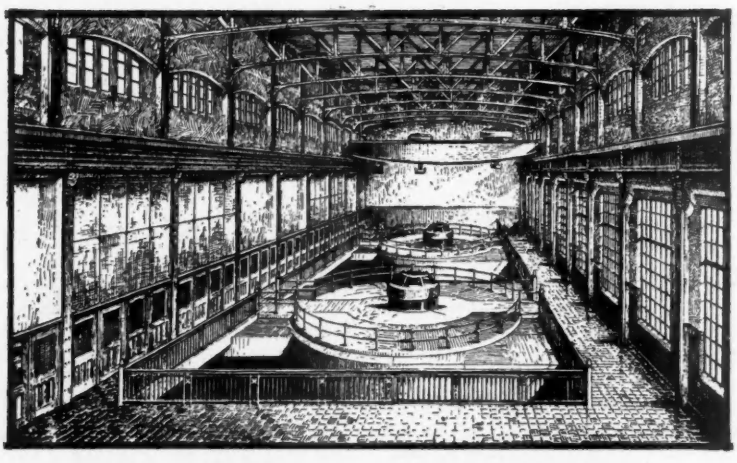


Fig. 11.—View of Power-house Interior on Completion.

An outstanding feature of the design of the power house (an architect's interior view of which is given in fig. 11) is that the machinery will be completely hidden. The initial dimensions of the generator room will be 268 by 62 feet, which provides for the first two units. At a later stage the building will be enlarged so as to provide housing for the entire four generators. In addition to the generator room, the main building will contain a control room and service room which will cover a ground space 56 feet square, and will be three storeys in height.

The generator room will be paved with quarry tile. Down the centre and railed off from the room the generator heads will protrude a little above the floor level. Main power wires will be carried under covered ways beneath the corridor and up the walls to the roof, where the switching station will be installed. The wires will be readily accessible for inspection, or adjustments, a means of an approach to which is being provided for mechanics under the covered ways. Wires passing through the side walls to the roof will be handled, if necessary, by the removal of wall panels.

The contract for the dam was the largest single contract let, and was awarded to the Vancouver B.C. firm of Stuart Cameron & Co., the general contractors for the Ruskin project, associated with Armstrong and Morrison, Vancouver. The work includes the construction of the dam, the lower portion of the reconstruction of the Stave Falls railway, and the excavation of the two tunnel intakes.

The Ruskin plant will be a peak-load installation, and the quantity of water in storage behind the dam will therefore be used more quickly because the total number of hours' use per day for given output will be less.

The mean flow of the Stave River is 4,200 cubic feet per second; the Stave Falls plant when fully loaded discharges 7,200 cubic feet a second, but the Ruskin plant, when completed and operating at full load, will draw water from the reservoir at the rate of 14,000 cubic feet per second. With the Stave Falls plant running, the Ruskin plant at full load will reduce the level of the reservoir at the rate of six inches an hour.

In round figures the Stave Falls plant has a capacity of 280,000,000 kilowatt-hours per year. The Ruskin plant, having no additional watershed and depending upon the same water, but at a slightly greater head, has a capacity of 315,000,000 kilowatt-hours per year.

The Ruskin plant, in view of its proximity to Vancouver, B.C., will also be in the nature of a stand-by plant which can take care of a heavy load for a short time in the event of a transmission line from one of the other plants being out of commission.

Additional power from the Ruskin plant will call for additional transmission lines for the factories, homes, and electric railway service of Vancouver, and the lower mainland of British Columbia. At present there are two high-pressure lines from Stave Falls, and a third line under construction, all on the north side of the Fraser River. Two additional lines, which will be entirely independent of existing circuits, are now being erected on the south side of the Fraser River. Even-

tually there will be altogether eight h.p. lines from the Alouette, Stave Falls, and Ruskin installations, and tie lines between each plant, and between circuits, which will enable current to be conveyed over any, or all, routes from any installation.

Contrasted with the Ruskin plant the Bridge River development, now proceeding at Seton Lake, 135 miles north of Vancouver, B.C., for the B.C. Electric, will be a base-load station. Because of the volume of water available at a head of 1,200 feet, this plant will be used for the base load, or continuous demand, in conjunction, of course, with the other stations in the B.C. Electric system.

The mainland system of the B.C. Electric Railway Company at present develops 157,200 h.p., made up as follows:—Lake Buntzen stations 1 and 2, 57,500 h.p.; Stave Falls plant, 72,500 h.p.; Alouette, 12,100 h.p.; Steam stand-by installation at Vancouver, 15,100 h.p.; total, 157,200 h.p.

The additional power of the Ruskin and Bridge River plants will bring the total up as follows:—Ruskin, completed 1930, 47,000 h.p.; Bridge River, completed 1932, 54,000 h.p.; total, 101,000 h.p.

The total development of the B.C. Electric Railway Company on the lower mainland of British Columbia by 1932 will, therefore, have reached 258,200 h.p.

Estimates of future growth are based upon the average rate of increase in the past, which for Vancouver, New Westminster, and the Fraser Valley and lower mainland, is 12 per cent. per annum compounded. This means that the demand will double in between six and seven years.

As the present peak demand is approximately 135,000 h.p., it will be seen that provision has to be made for 270,000 h.p. by 1936, and 540,000 h.p. by 1943.

At the same time the distribution system must be similarly extended, as it is estimated that for every two dollars spent on development, one dollar must be spent on distribution. It will thus be seen that nearly $40,000,000 will be necessary for electrical development of the company within the next seven years. It must be remembered that this covers only the lower mainland of British Columbia, which is the major area served by the company. The B.C. Electric recently purchased the municipal power plant at Kamloops, in interior British Columbia, and further development will be undertaken there.

On Vancouver Island, which is very much larger than the whole of Ireland, the company serves another large territory, of which Victoria, the provincial capital, is the centre. This city is located at the southern end and is now served by the Jordan River plant, where extensive additional development work is under way, and by two other smaller plants. At the northern end of the island the B.C. Electric has just been awarded the water rights for Campbell River Falls, the largest potential power source on Vancouver Island, and this will cost several millions to develop within the next few years. On the west coast the company has just acquired a chain of municipal stations, and additional power development is immediately necessary in the vicinity to fulfil the terms of the contract on which purchase of the electricity generating installations by the B.C. Electric and the granting of franchises to that company were approved by the ratepayers of the various towns and municipalities.

Electricity for the Home.

How Hot Water is provided for the Ordinary Household in Southampton.

By W. P. CONLY, M.Sc., A.M.I.E.E.

MUCH has been written upon the heating of water by electricity for domestic purposes, and the subject has been thoroughly investigated from many angles. The author of the present article, however, wishes to present the matter from a comparatively new viewpoint, and one which, though sadly neglected in the past, he considers to be of the utmost importance.

Of all the many uses of electricity in the home, the heating of water has not been considered to rank as the least expensive, except where a very cheap rate for electricity for that purpose had been offered by the supply authorities. It appears that most of the schemes up to the present have been considered in connection with houses valued at £1,500 and upwards, wherein a copious supply of hot water is required to be always on tap and a cost of from 6s. to 10s., or even more, per week is not thought to be excessive.

There are, however, in this country, many householders who could not possibly afford to pay anything approaching such an amount for a supply of electrically-heated water. It is true that, except in extreme cases and with very favourable tariffs, such householders could not obtain an unlimited supply of electrically-heated water constantly on tap for a smaller sum, but a merciful providence and stern necessity regulate their requirements to a far less exacting demand. The fact remains, however, that the middle-class man with a house of up to, say, £1,000 in value, the clerk, the skilled artisan, the ordinary workman, and the flat dweller, in fact, the man in the street, has never been catered for in this direction until very recently.

When we remember that these "ordinary households," as we may call them, are in the great majority in this country, we shall also realise the enormous field which yet lies to be explored and the wonderful harvest which is waiting to be garnered by the supply authorities, the electrical wholesalers and the electrical contractors. The ordinary householder does not demand a supply of hot water always on tap day and night. He requires one or two bath nights a week, hot water in the morning for shaving and toilet purposes, and a plentiful supply for washing up the dishes. Give him that and he is satisfied.

The problem before us, therefore, is how to satisfy this modest demand in the cheapest possible way to the consumer. Until quite recently there have been five well-known methods of supplying domestic hot water electrically. These are:—

1. Immersion heaters inserted in existing hot-water storage tanks, with which may be included tank belts.
2. Electric geysers.
3. Thermal-storage tanks.
4. Electric wash boilers.
5. Electric kettles.

The electric kettle (fig. 1) cannot supply the whole of the requirements of the ordinary household, and for that reason it is often ignored; yet this sturdy little fellow plays a yeoman part in the domestic hot-water supply and deserves to be considered first. All day long and day after day it is pressed into service and carries out its duties with reliability and efficiency. The type of kettle in which the element takes the form of an immersion heater actually surrounded by the water is parti-

cularly efficient and speedy, while an earthing device and a simple protective system insure against catastrophe in the hands of a careless user.

1. *The Immersion Heater.*—The immersion heater naturally assumes the existence of a domestic hot-water tank. This, however, is not always present. The ordinary householder has, perhaps, previously relied

Fig. 1.—Kettle with Ring-type Immersion Heater.

on a gas geyser or the family copper to provide for his bath. Where, however, there is already a hot-water system laid on, then the immersion heater is an added boon. In the ordinary household the boiler will most likely be installed behind the living-room grate. This is indeed a very convenient position for it in winter, as one fire only is required for the dual purpose of heating the home and providing hot water. In the summer months, however, a roaring fire in the living room is apt to be somewhat of a nuisance; it is then that the immersion heater comes into its own. The most economical size for our particular purpose has a loading of about 2½ kilowatts; it should be inserted horizontally in the hot-water tank in such a position that about 20 gallons of water is above it. Contrary to general opinion, the writer advocates no lagging on such a tank when used in an ordinary household, and a thermostat need not be used in this case It must be remembered that we are not calling for hot water day and night, but merely for the occasional bath. With the comparatively high loading of 2½ kilowatts, a bath may be obtained in from one hour to an hour and a half, depending upon the temperature, the quantity of water required, and the time of the year. In that comparatively short time the heat lost through radiation from the unlagged tank is perhaps even less than the heat lost in heating up lagging from cold; this is especially the case if the tank is situated in an airing cupboard, and the lost heat is very useful for airing purposes. If the hot-water tank is circular, then a tank belt can be used with advantage, in that it is not necessary to drill the tank to fit it. The element in this case is long and slightly flexible. It can be wrapped round the tank and secured in the desired position. A specially shaped outer covering fitted over it forms an air lagging to prevent loss of heat.

2. *Electric Geysers.*—The electric geyser is certainly a very handy article for our purpose. It takes up very little room, and no special plumbing work is required. The loading, however, is usually very high, being from 6 to 8 kilowatts, and some undertakings object to such a load being suddenly thrown on to the mains. Even with the high loading, about half an hour is required to obtain a nice hot bath, and the hot water, being spread out in the bath as it were, is liable to cool very quickly, especially in the winter time. Furthermore, the bath requires constant attention whilst filling, but that is a point which will be discussed later.

3. *Thermal-storage Tanks.*—The thermal-storage tank of the fully lagged type, complete with thermostat (fig. 2), is certainly almost a necessity where hot water is required day and night, but for the case in point it possesses many disadvantages. The 11-gallon size of tank has a radiation loss of about 1 kWh per day. This is negligible when in constant use. But 1 kWh per day is equivalent to 7 kWh per week, and such a loss is quite appreciable when spread over two or three baths only. Furthermore, the loading is very low, perhaps only 750 watts, so that after one bath full of hot water has been drawn off it will be four to six hours before any more hot water can be obtained. It is therefore impossible to obtain two or three baths one after another, and the ancient institution of " bath night " cannot be accommodated. Furthermore, the lagged type of thermal-storage tank cannot be considered to be cheap in first cost, which is a very great consideration in our particular case.

4. *Electric Wash Boilers.*—The electric wash boiler is a very efficient and useful article, but its sphere of usefulness is restricted almost solely to " washing day." The scope of the present paper lies more in the question of providing hot water for the bath and other toilet purposes. This being the case, the wash boiler may be dismissed without further discussion. None of the above methods, therefore, is ideal for the " ordinary household " and there is nothing for it but to search further.

The Southampton Corporation Electricity Department has already ventured forth in this direction and the results have been most gratifying, as the following notes will show. One interesting point has been the psychological effect upon the consumers. When a complete electric system of domestic hot water had been installed in a large residence, the ordinary householder would remark: " Oh yes, he can afford it," and there the matter would rest, but when a working man was persuaded upon the venture and it was found that electricity would meet all his requirements for hot water at a cost as low as, if not lower than, any other method, and certainly far more conveniently, then the ordinary householder rubbed his eyes and said: " Well, if it pays him, it will pay me." The result in this particular undertaking has been that, whereas the wealthier consumers instal electricity for domestic water heating in their ones and their twos, the ordinary householders demand such facilities literally in their dozens, and, what is more gratifying, they are entirely satisfied.

After giving the matter much thought, the electricity undertaking in question considered that an immersion heater fitted in the existing hot-water tank had many advantages, and many were sold for this purpose. Most

Fig 2.—A Thermal-storage Tank.

Fig. 3.—The " Southampton " Tank.

of the ordinary householders, however, did not possess an existing hot-water tank—so the obvious thing to do was to provide a tank into which the immersion heater could be fitted. Gas geysers cost from £5 10s. to £7 10s., so that to compete with them the electric tank complete had to cost even less. Manufacturers of reliable thermal-storage tanks were approached, and one well-known firm bravely offered to co-operate. Thus was the " Southampton Type " tank, fig. 3, produced.

(To be concluded.)

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Agreement between the English Electric and Westinghouse Companies.

The ENGLISH ELECTRIC CO., LTD., announces that it has entered into a comprehensive arrangement with the Westinghouse Electric International Company, of New York, and the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, U.S.A., whereby there will be an exchange of technical information between the two organisations on steam turbines and electrical apparatus. The arrangement includes the granting of licences for the use of patents and for the manufacture and sale of various products. These licences will be subject to the existing commitments of the two companies in various parts of the world. Under this arrangement the English Electric Co. will have the benefit of the results of the extensive research work carried on by the Westinghouse Electric & Manufacturing Company.

The English Electric Co., in making this announcement, desires to make it clear that the technical and manufacturing link thus established does not carry with it any control from America. The British interests in control of the company, believing that a moderate financial interest on the part of the American Westinghouse Companies would be highly desirable, has offered a participation in the ordinary shares of the company at par, but this participation will be under 10 per cent. of the total. If the offer is accepted this will increase the new money provided under the scheme of reorganisation.

Scottish Electrical Contractors.

Our printers were responsible for a more than usually absurd error in the note appearing under this heading in our last issue. Mr. Johnston Foggo's name was mentioned and was set out in capitals in the manner of a degree or qualification. We tender our apologies to Mr. Johnston Foggo and to those of our readers who were puzzled to know for what the remarkable initials stood.

Visit to Hopkinsons' Works.

About 90 members of the North-Western Branch of the Institution of Mechanical Engineers recently visited the works of Messrs. Hopkinsons, Ltd., Huddersfield. The members were entertained to lunch at the George Hotel, and then under the guidance of members of the staff, they made a complete tour of all departments, including pattern shops and stores, steel, iron, bronze and "Platnam" foundries, rough material stores, brass machine shop, iron and steel machine shops, tool room, finished part stores, fitting and testing departments, mine signal and electric control departments, laboratory, and centrifuge department, where demonstrations of Hopkinson centrifugal separators were given. At the conclusion of the tour, which lasted about two hours, the party was entertained to tea. Mr. H. L. Guy thanked the firm for its hospitality and Mr. Robert A. Hopkinson (chairman and managing director) briefly responded.

A New Neon-Light Company.

In our issue of May 2nd (p. 834) we recorded the registration of Claude-General Neon Lights, Ltd., with an authorised capital of £218,000, to exploit the neon system of lighting. It is now announced that the directors of the company are as follows:—Messrs. J. Y. Fletcher and C. Wilson, representing the General Electric Co., Ltd.; W. T. P. Hollingsworth (United States) and E. C. Parent (France), representing M. Georges Claud; and Herr J. J. Seiss, representing the A.G. für Elektricitäts Industrie, Berlin. Mr. S. D. Moyse is secretary and manager of the company.

The Trade of British West Africa.

A report on this subject by Mr. A. W. Hall, of the office of the Senior Trade Commissioner in South Africa, has been issued by the Department of Overseas Trade. (Reference No. C.3275.) From this it is seen that the market for electrical goods and machinery is a very small one and about half of the purchases are on Government account. In 1928 imports of electrical machinery into the various sections of the territory dealt with had the following values: Gold Coast, £57,666 (£22,563 in 1929); Nigeria, £14,047; Sierra Leone, £194; and the Gambia, £69. This machinery was nearly all of British origin. Some of the mining companies have their own power plants; the usual voltage in the towns is 230 or 250. Under the heading "Electrical and telegraph apparatus" the following values of imports during 1928 are given: Gold Coast, £73,217 (£60,327 in 1929); Nigeria, £79,129; Sierra Leone, £35,114 (£17,626 in 1929); and the Gambia, £2,814. This was mainly imported for the Government and was of British origin. The Gold Coast section of the report says that there are now electric light and power plants in Accra, Sekondi, Kumasi, Koforidua and Aburi, and schemes for installations in other towns will doubtless be proceeded with when financial conditions are less stringent. No reference is made in the report to the undertaking of the Nigerian Electricity Supply Corporation which commenced supplying energy last week.

Merchandise Marks Inquiry.

The inquiry as to whether imported motor cars and accessories, including magnetos, batteries and ignition plugs, should be required to bear an indication of origin, which was to have been held on July 7th, has been postponed and will probably be held in September or October next.

Proposed Austrian Tariff Changes.

Details of alterations which the Austrian Government proposes to make in its Customs tariff appear in the *Board of Trade Journal* for June 12th. The alterations do not affect the goods of countries like Great Britain which enjoy most-favoured-nation treatment. In the case of these countries the existing "conventional" rates will remain in force until their treaties with Austria are abrogated or amended. The amendments, generally, take the form of increases, which in the case of electrical and allied goods range from about 5 per cent. in the case of small apparatus to 100 per cent. for telegraph and telephone apparatus. A new note in the tariff states that in the case of dynamo-electric machinery, transformers, &c., the Government may reduce or suspend the duties on goods of kinds not produced in Austria.

Lamp Sales in the United States.

During 1929 a total of 344 million large tungsten-filament lamps were sold in the United States, according to a report of the Lamp Committee of the National Electric Light Association which has just been published. This is the greatest number of lamps ever sold in any one year and represents an increase of 8.7 per cent. over the previous year as compared with a 3.8 per cent. increase in 1928 over 1927. More than 15 million carbon lamps were sold during the year, as compared with 12 million sold in 1928, of which 88 per cent. were imported. These figures do not include miniature lamps, such as those used in flashlights, automobiles, and for decorative purposes. Of these, nearly 260 million tungsten-filament and 19 million carbon-filament lamps were sold, the largest number being for use on automobiles, which totalled 138½ million.

Registered Electrical Contractors.

Applications from the following contractors for registration were accepted by the executive committee of the National Register of Electrical Installation Contractors at its last meeting:—Saraikin, S. P., Moss Side, Manchester; Gazard, W. A., & Son, Ward End, Birmingham; Roberts, C., West Ardsley, nr. Wakefield; Terry, S., Canterbury; Oates, Edgar, Ltd., Oldham; Bentley-Hunt, J. E., Bath; Craven, F. (trading as W. P. Holt & Co.), Bradford; Milne, Alex. & Co., Glasgow; Smith, J., Preston; Greenwood, D., Bingley; Smith & Lamerton, Gloucester; Mountford, H. H., Birmingham; Carter, J., Bradford; Edwards & Godding, Ltd., Newbury, Berks.; Nash, H., Notting Hill Gate, W.11; Fraser & Borthwick, Ltd., Glasgow; Trapnell, G. H., New Brighton; Dargue, A. E., Wallasey; Exors. of R. J. Atkins, Oldbury; Central Electric Co., Rushden, Northants.; Butcher, E., Sparkbrook, Birmingham; Hamilton, Claude, Ltd., Hillhead, Glasgow; Cambridge Electric Supply Co., Ltd. At the same meeting one application was withdrawn and nine were declined.

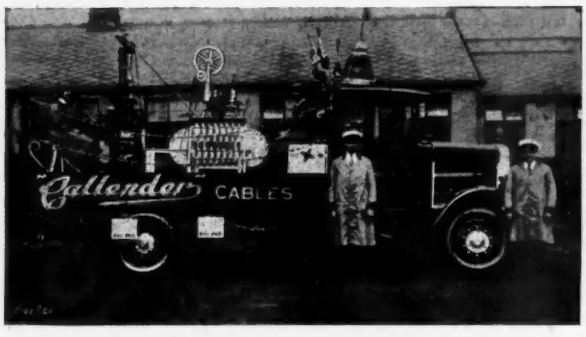
East African Customs Tariffs.

The *Board of Trade Journal* for June 12th contains details of the new Customs tariff put into force on April 17th last by the Governments of Kenya, Uganda and the Tanganyika Territory. From this it is seen that free entry is granted to the following classes of goods, *inter alia*:—" Machinery, apparatus, appliances and instruments (not including tools or domestic and toilet machines, or appliances elsewhere provided for) and electrical material used in connection therewith, for the generation, storage, transmission, distribution of, or lighting by, gas or electric power, and parts thereof, but not including electroliers, gasoliers, lamps, lampshades or reflectors, portable batteries or electrical appliances for use in connection with vehicles "; refrigerating machinery; and telegraphic, telephonic and radio materials, equipment and instruments. A note at the end of the tariff is to the effect that all goods not provided for under any heading in the tariff or under any special law relating to the Customs are dutiable at 20 per cent. *ad valorem*.

Displays by Cable Companies.

We reproduce below a picture of a tableau entered by CALLENDER'S CABLE & CONSTRUCTION CO., LTD., in a recent demonstration in aid of the Leigh Infirmary. It was a working exhibit comprising a braiding machine and a multiple cotton-covering machine driven by an electric motor fixed on the lorry. The display won the first prize and the lorry won the first prize for heavy vehicles.

Our second illustration depicts another cable-making company's entry in a horse show and parade at St. Helens. This was arranged by BRITISH INSULATED CABLES, LTD., and



A Working Exhibit by Callender's.

A British Insulated Tableau.

Two Cable Manufacturers' Displays.

was of a nature appropriate to the district—showing the use of Lancashire cotton in cable manufacture. A silver cup was awarded for the best decorated turnout and the company was also awarded the first prize for the best horse in its class.

Central Electricity Board Contract.

The ENGLISH ELECTRIC CO., LTD., has received an important contract from the Central Electricity Board for transformers for the Mid-East England Scheme. The contract is for 16 units totalling 130,000 kVA and comprises the following: Six 10,000-kVA, 66-kV transformers, two each for Kirkstall, Harrogate and York; two 10,000-kVA, 22-kV transformers for Huddersfield; four 7,500-kVA, 33-kV units, two each for Peterborough and Barnsley; and four 5,000-kVA, 33-kV transformers, two each for Rotherham and Doncaster. Each unit will be complete with " English Electric " on-load tap changing gear. The English Electric Co. claims that it is the only manufacturer to have in hand transformers for all the regional schemes for which orders have been placed.

United States Electrical Exports.

The electrical export trade of the United States suffered a set-back in March, the total value of $13,029,910 falling short by $1,264,719 of the March, 1929, figure. Among the classes which contributed to this decline were the following:—Batteries and accumulators, which fell in value from $1,026,665 to $700,405; steam turbo-generator sets, from $290,540 to $24,783; d.c. generators, from $192,391 to $143,250; accessories and parts for motors, from $369,911 to $253,850; radio apparatus from $1,486,898 to $1,267,658; lighting, starting and ignition equipment, from $526,603 to $367,019; and insulated copper wire and cable, from $692,085 to $502,567. There were also several large increases, among them being power and distribution transformers, from $215,840 to $451,076; telephone apparatus, from $349,449 to $746,484; and bare copper wire, from $405,597 to $649,888. About a quarter of the exports went to Canada whose share was valued at $3,026,126. Next in order came the United Kingdom ($941,508), Soviet Russia ($916,795), Mexico ($763,515), Argentina ($669,275), and Chile ($604,254).

Imports of electrical goods into the United States had a value of only $180,191. The United Kingdom supplied radio and telegraph apparatus.

American Activities in Norway.

The Oslo correspondent of the *Financial Times* reports that it is officially announced that the Standard Electric Company has acquired a majority holding in the Scandinavian Cable and Rubber Manufacturing Company, the largest Norwegian cable manufacturers. It is understood that substantial amounts will be spent on the extension and modernisation of the Norwegian plant.

Patent Application.

Application has been made by C. L. Hamel for the restoration of Patent No. 263,800 (32,312 of 1926) granted to him for " Method and Means for the Repetition of Telegraphic Signals," which lapsed owing to non-payment of the renewal fee.

The World's Radio Trade.

We regret that in the article under this heading in our last issue we gave the impression that the information was derived solely from a German source by the Department of Overseas Trade. The fact is that the Department collected the information from a number of sources and collated it in a very able manner for the benefit of British manufacturers and traders.

Book Notices.

" Water Power Exploitation in Germany," chief editors, Regierungsbaurat Lippert, Baurat Galland and Professor Dr. Ludin. English edition. Pp. 50+391; illustrated. Deutsche Wasserwirtschafts-und Wasserkraft-Verband E.V., Berlin. Price Rmk. 25.—A special publication for the session of the Second World Power Conference at Berlin, prepared with the assistance of the Governmental Departments of the Reich and the German States. The book, in addition to containing general articles dealing with the fundamentals of water power exploitation, also embodies valuable recently-obtained statistics and detailed descriptions, hitherto unpublished, of the most important German water-power installations. The descriptions of the works are based throughout on official data, and have for the greater part been provided by the Governmental departments mentioned. The work provides information regarding the present position of water-power exploitation in Germany, and is also intended to give foreign visitors to the World Power Conference a survey of German activities in the field of water power.

We have received a copy of the first (May) issue of a new Spanish monthly journal devoted to industrial engineering, the *Revista de Ingenieria Industrial*, which is the organ of the Spanish National Association of Industrial Engineers, and is published at Marqués de Valdeiglesias, I, Madrid. The issue contains an article by Senor José Morillo, professor of electricity at the Central School of Industrial Engineers, on estimating the supply of a.c. energy when the power factor is less than unity. Other articles deal with industrial or syndicate control of production, the petroleum question as affecting Spain, a new turntable for locomotives, and the automatic control of aeroplanes.

" Autobiographical and Other Writings," by A. A. Campbell Swinton. Pp. xiii+181; plates 18. London: Longmans Green & Co., Ltd. Price, 10s. 6d. net.

" Electrical Wiring and Contracting," edited by H. Marryat. Vols. VI and VII. Pp. vii+vii+1267–1808. London: Sir I. Pitman & Sons, Ltd. Price 6s. net each.

A Swedish Lamp Amalgamation.

It is announced that a fusion has taken place in the Swedish incandescent lamp industry by the amalgamation of the Osram Aktiebolag and the A.B. Elektraverk under the title of the A.B. Osram-Elektraverk, with a share capital of 2,500,000 kr. The production of " Osram " and " Kung " lamps has already been started at Stockholm.

Germany's Foreign Electrical Trade.

According to the official trade returns just to hand, the imports of electrical machinery and apparatus into Germany during the first quarter of this year attained a value of

£573,550, as compared with 587,700 in the corresponding period of 1929. The exports of similar material from Germany reached a total of £7,396,350, as compared with £6,581,950 in 1929.

Polish Electrical Schemes.

We stated in our last issue that the Polish Government had rejected the electrification scheme propounded by Mr. W. A. Harriman. The Polish Minister of Public Works is now reported to have stated that, among others, a French group two months ago submitted a scheme for the electrification of Poland, but that a decision had not been reached in the matter. It appears that a syndicate has been formed in Paris to promote the French project with the support of French and Austrian banks, while the Harriman group is rumoured to be also participating in this French group.

Large " English Electric " Transformers for Budapest.

The accompanying illustration shows the 150-ton crane at Hamburg Docks lifting what is probably the largest transformer yet shipped from England immersed in oil in its own tank. The unit in question is one of three 20,000 kVA, 3-phase, 110,000-V transformers manufactured for the Hungarian Government at the Stafford works of the English Electric Co., Ltd., as part of the extensive contract on which the company is engaged in connection with power supply and railway electrification in the Budapest district. The transformers are of the five-limb core type and each is provided with two banks of radiators mounted separately and equipped

A 46-ton " English Electric " Transformer being handled at Hamburg.

with air-blast cooling and auxiliary oil-circulating pumps. On-load tap-changing gear of the " English Electric " mid-point auto-transformer design is fitted.

It is a great advantage to transport large high-voltage transformers in oil since this eliminates the lengthy and troublesome process of drying out on site. The largest units for the grid are now transported in this condition, but shipment overseas of the heavy individual pieces involved by this method is governed wholly by the lifting capacities at the points of trans-shipment and the railway facilities in overseas countries. The weight of the consignment illustrated is 46 tons.

Bankruptcy Proceedings.

J. G. WADSWORTH, 10, Westfield Terrace, Higham Ferrers, trading as the " Nene Road Electrical Co.," electrical engineer, &c.—The public examination herein was held at Northampton on June 6th. The statement of affairs showed liabilities of £135, and a deficiency of £124. It was reported that the debtor started trading on his own account in 1928, with a capital of 10s. He did electrical wiring work and motor repairing. For about two or three months he was in partnership with another at Wellingborough, and later he was a partner in another business at Rushden. The debtor had kept no books of account. The examination was adjourned.

L. E. HEMBER, 4, Pepper Street, Lymm, Cheshire, electrical engineer.—The public examination of this debtor was held recently at the Court House, Warrington, when a statement of affairs was produced showing liabilities of £994 and a deficiency of £693. The debtor stated that he commenced trading in August, 1927, his only capital being £35. He attributed his failure to lack of capital and keen competition. The hearing was concluded.

J. W. HUNT, electrical engineer, 220, Wells Road, Bristol.—Receiving order made June 5th on debtor's petition.

H. TURNER, radio and electrical contractor, 20, Battersea Rise, Clapham Common, S.W.—Receiving order made June 11th on debtor's petition.

H. D. DOUGLAS, engineer, contractor, wireless factor, &c., 42, Bromley Road, Catford, S.E.6.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, released May 16th.

G. T. BAINES, electrical engineer, 66, High Street, Gorleston.—Trustee, Mr. C. B. L. Prior, 4, Eastbourne Place, Prince of Wales Road, Norwich, Official Receiver, released May 23rd.

E. AMOS & E. C. WRIGHT (Amos & Wright), electrical and motor engineers, 32, Slater Street, Liverpool.—Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield, released April 2nd.

T. W. B. DURANT, electrical and motor engineer, Coit Lane, Chapeltown, near Sheffield.—Last day for receiving proofs for dividend June 28th. Trustee, Mr. B. S. Briggs, County Chambers, King Street, Wakefield, Official Receiver.

Company Liquidations.

LAMBERT LAWS, LTD., electrical and radio engineers, 15, Gloucester Place, Brighton, and 109a, Chapel Road, Worthing.—The statutory meeting of creditors was held on June 10th at the offices of Mr. A. E. Orbell, 6 and 7, Old Steine, Brighton. The statement of affairs showed ranking liabilities of £2,687 and net assets of £2,323, leaving a deficiency so far as the creditors were concerned of £364. The company was registered in March, 1928, with a capital of £2,000, to take over a business carried on by Mr. Ernest Lambert at Brighton. The assets were valued at £2,670, and the company agreed to discharge liabilities of £670, and to allot to the vendor or his nominee fully paid shares to the value of £2,000. The first directors were Mr. and Mrs. Lambert and subsequently Mr. A. W. Finn joined the board. The business at Worthing was opened in May, 1928. The accounts for the year to March, 1929, showed sales, &c., of £6,682, against purchases of £5,630. There was a gross profit of £1,024, but a net loss of £537 was incurred. During the following year the sales were £8,392, the purchases being £7,717, and there was a further net loss of £180. The deficiency was attributed to loss on trading and depreciation written off the assets in the statement of affairs. The voluntary liquidation of the company was confirmed with Mr. Orbell and Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., as joint liquidators with a committee. The following are the principal creditors :—

	£		£
Credenda Conduits, Ltd.	203	Cole, E. K., Ltd. ...	53
Electric Lamp & Supplies Co., Ltd.	134	Burton, C. F. & H. ...	71
Shaw, J., & Sons, Ltd.	117	Humphreys Bros. ...	69
Ferranti, Ltd.	108	Lever, Eric. J., Ltd. ...	82
Revo Electric Co., Ltd.	102	Dwyer & Co., P. L. ...	54
Siemens Bros. & Co., Ltd.	98	Northern Steel & Hardware Co., Ltd. ...	56
W.T. Henley's Telegraph Works Co., Ltd. ...	81	Three Star Accumulators, Ltd.	63
Marshall Electric, Ltd.	95	Parsons, C. H., Ltd. ...	55
Electric Cables, Ltd. ...	76	Tungsram Electric Lamp Works (Great Britain), Ltd.	62
Lighting Trades, Ltd. ...	103		

K.N. ELECTRICAL PRODUCTS, LTD.—First meetings of creditors and contributories, June 20th, at 33, Carey Street, Lincoln's Inn, W.C.2.

Private Arrangements.

G. TURNOCK, electrical engineer, 41, High Street, Aston New Town, and 25, Havelock Road, Handsworth, Birmingham.—At a recent meeting of creditors a statement of affairs was submitted which showed liabilities of £3,347, of which £1,147 was due to the trade and £2,200 to a cash creditor. The net assets were £607, leaving a deficiency of £2,740. It was stated that the debtor had been carrying on business for about 25 years. The last balance sheet was prepared as at December, 1926, and at that date the liabilities just exceeded the assets. Since then the turnover had been approximately £20,500, and a loss of £1,160 had been incurred. The deficiency was attributed to the loss on trading and the depreciation written off the assets. A deed of assignment had already been executed and a resolution was passed confirming the deed subject to the cash claim for £2,200 being postponed or withdrawn.

V. E. PEARN, electrical engineer, trading as E. Brown & Co., 387, Bath Road, Bristol.—A meeting of creditors was held at Bristol on June 12th, when it was stated that the liabilities were approximately £250, whilst the assets consisted of book debts estimated to realise about £20, and plant valued at about the same amount. The business was commenced in 1924. No particulars of trading were available, but it was stated that the drawings had been small. Recently creditors had been pressing and the debtor attributed his position to trade depression, lack of capital, and keen competition. An offer was made of a composition of 5s. in the £, payable in cash, and this was accepted.

Winding-up Petitions.

MAYFAIR ELECTRIC GRAMOPHONES, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. Morton, Moller, Sheen & Co., Capel House,

New Broad Street, E.C.2, and will be heard in London on June 23rd.

Cheap Electric Power Corporation, Ltd.—A winding up petition has been presented to the High Court by Madeline F. Marshall, and will be heard in London on June 23rd.

Reductions of Capital.

Watts Fincham & Co., Ltd.—A petition has been presented to the High Court for the confirmation of the reduction of capital from £120,000 to £25,000, and will be heard in London on July 15th.

Marco Refrigerators (1929), Ltd.—A petition for the confirmation of the reduction of capital from £200,000 to £130,000 will be heard in the High Court on June 24th.

New Catalogues and Lists.

Foster Engineering Co., Ltd., Apex Works, South Wimbledon, S.W.19.—A well-produced brochure issued to mark the completion of 25 years of progress, in which the history of the company is outlined, with illustrations of the company's works and products.

Messrs. Alan Wright, 117, Victoria Street.—Two showcards and two leaflets prepared to assist electricity supply authorities and others to interest the public in electric water heating. Particular reference is made to the "Inventum" water heater.

Messrs. Oswald Record & Co., 17, Victoria Street, S.W.1.—A descriptive leaflet dealing with portable pressure transformers (model HCM) for tests in workshops and laboratories.

D.P. Battery Co., Ltd., Bakewell.—A booklet illustrating and describing "Kathanode" traction cells, used on cleansing and municipal vehicles.

"R.B." Manufacturing Co., Reliance Works, Johnstone Street, Ladywood, Birmingham.—An illustrated and priced folder advertising "R.B." patent adjustable focusing brackets for shop-window lighting.

Soapstone Products Co., Terminus Chambers, 6, Holborn Viaduct, E.C.1.—An illustrated leaflet, giving brief particulars of soapstone electric radiators. Priced.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A number of new and revised leaflets for insertion in the company's sectionalised catalogue.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—A June stock list of a.c. and d.c. motors, transformers, &c.

M.K. Electric, Ltd., Wakefield Street, Edmonton, N.18.—Two illustrated leaflets drawing attention to "M.K." plugs and sockets.

Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, Manchester.—A booklet giving details of a new chain clutch designed by the company. Illustrated.

English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publications Nos. M21, K90, and M24, describing respectively arc welding at a large boiler works; power factor correction, systems and economic results; and the Alouette hydro-electric generating station, with illustrations of plant installed by the company.

Bull Motors, Ltd., Ipswich.—An illustrated booklet describing the "Bull" eddy current brake for use on railless cars.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for June contains a number of interesting articles on floodlighting and other lighting installations carried out with the company's equipment.

Higgs Motors, Witton, Birmingham.—A stock list for June of the company's a.c. and d.c. motors.

Trade Announcements.

The Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4, states that it has discontinued the manufacture of "Neco" 6-in. and 8-in. tool grinders in order to concentrate upon the production of motors.

The office of the Cambridge Electric Supply Co., Ltd., has been removed to 4, Market Hill, Cambridge.

The Carrington Manufacturing Co., Ltd., is holding a trade exhibition of its cabinets for wireless sets at 24, Hatton Garden, E.C.1, from June 27th to July 5th.

On and after June 21st, the whole of the business of Radio Instruments, Ltd., will be transferred to new premises in Purley Way, Croydon (Telephone: Croydon 3211; telegrams: "Instradio-Croydon"). Mr. Lawson (of Brown Bros., Ltd.) is taking charge of the company's sales department.

For Sale.

Messrs. Henry Butcher & Co. will sell by auction at the London Auction Mart, 155, Queen Victoria Street, E.C.4, on July 10th, the factory of Submersible Motors, Ltd

The West Central Merchandise Mart will sell by auction at York House, Southampton Row, W.C.1, the stock of a cable exporter and electrical factor.

Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on July 8th the Stamp End works of Messrs. Clayton and Shuttleworth, Ltd.

Nelson Corporation has for disposal a large number of d.c. meters.

Mr. H. J. Shaw will sell by auction on June 25th at 13, High Holborn, W.C.1, electrical and wireless material.

(See our advertisement pages to-day.)

Electrical Imports of Jugo-Slavia.

The imports of electro-technical machinery into Jugo-Slavia during last year attained a value of £677,800, as compared with £584,350 in 1928.

Unemployment.

There was an increase of 5,049 in the number of registered unemployed during the week ended June 2nd, on which date the total was 1,775,100, as compared with 1,770,051 on May 26th, and 1,100,125 on June 3rd, 1929. It is estimated that on May 26th there were approximately 9,723,600 insured persons aged 16 to 64 in employment in Great Britain. This was 75,300 fewer than a month before and 535,900 fewer than a year before.

Unemployment in Germany.

The number of unemployed in Germany receiving public relief on May 31st was 1,889,000, and the total number of unemployed is estimated to be about 2,637,000. This is 1,290,000 more than on the corresponding date last year and 90,000 more than two weeks ago.—*Reuter* (Berlin).

Recent Contract.

The Municipal Council of Sydney, New South Wales, has placed an order with Messrs. Johnson & Phillips, Ltd., for approximately £30,000 worth of heavy power cable.

The Gasfilled Lamp Patent.

The Zenith Electric Co., Ltd., of Zenith Works, Villiers Road, Willesden Green, London, N.W.2, writes asking us to state that it is not associated in any way with the Zenith Electrical Supplies Co., whose name appears in the advertisement appearing on page 22 of the Electrical Review of June 13th. We are asked to state this as already confusion and misconception has arisen in the trade.

Prices of Materials.

Messrs. Edward Till & Co. report, June 17th: India-rubber, Para fine, 7½d., ¼d. dec.

Messrs. James & Shakespeare report, June 17th: Copper bars (best selected), sheet and rod, £83, £4 dec.

Messrs. James Forster & Co.'s letter of June 13th stated that the lead market was very quiet last week and in spite of some official support, values tended to sag away and closed at the lowest. Similar conditions exist in the trade where demand is slack although consumption is fairly well maintained. Arrivals so far this month have been moderate but sufficient for requirements, although in some cases a premium has been paid for prompt delivery. It is very doubtful whether the present price level can be maintained.

Lighting and Power Notes.

Aldershot.—Mains Extensions.—The Town Council has decided to carry out mains extensions at an estimated cost of £2,095.

Australia.—Melbourne.—The returns of the Electricity Commissioners for the quarter ended March 31st show a total revenue from the electricity undertaking and the sale of briquettes of £467,286, as against £403,619 in the corresponding quarter last year. The total expenditure including interest, depreciation, and sinking fund charges, amounted to £466,139, as compared with £402,262, leaving a profit of £1,147 (£1,357). The sales of electricity for the quarter increased from 83,036,360 to 90,874,566 kWh, and the maximum demand upon the system was 80,000 kW. The number of towns receiving supplies from the Commission is now 148, an increase of nine as compared with the corresponding period last year. Good progress is being made with the duplication of the plant at the Yallourn station and in the erection of a new terminal station at Richmond. The terminal station and transmission line will probably be completed in July and will enable the full output of the Yallourn station to be transmitted with safety.

Bangor.—Loan.—The City Council is to apply for sanction to the borrowing of £11,295 for the development of the electricity undertaking.

Belgian Congo.—Water-power Development Proposals.—The Belgian technical commission which has been inquiring into the possibilities of utilising the water-power of the Lower Congo for electricity generating purposes has reported that by constructing a canal about 6¼ miles in length starting about 12 miles from Isanghila, a storage lake can be constructed which under a head of 311 ft. would give up to one million kW. It is proposed, however, that a shorter canal should be constructed at first, which, with a head of 48 ft. to 60 ft. would give 58,000 kW.

Blackpool.—Mains Extensions.—In connection with an electricity scheme for Marton, an extension of the street mains estimated to cost £3,000 has been sanctioned.

Bromley (Kent).—Mains Extensions.—The Town Council has decided to expend £4,187 on mains extensions, and £900 on mains extensions and transformer station when required

for the telephone exchange to be erected at the corner of Coates Hill Road. The question of a supply to Bromley Common has been deferred, pending further building developments, owing to the length and cost of the necessary main.

Canada.—POWER STATION FOR GREAT LAKE COAL AREA.—The New Brunswick Electric Power Commission is to proceed immediately with the construction of a power station in the Grand Lake coal area. Electricity will be generated by steam produced from pulverised coal obtained from the mines of the Grand Lake coalfields, which have reserves estimated at 70,000,000 tons. The plant will supply all the power for York, Sunbury, and Queens Counties, and will provide a large and important market for the mines of the Grand Lake coal area. The Commission has completed negotiations for a supply of from 2,500,000 to 3,500,000 kWh per annum for the cotton mill at Marysville.

Carlisle.—ASSISTED WIRING SCHEME RESTRICTED.—The Corporation Joint Gas and Electricity Committee has decided that, in future, the number of houses to be wired for electricity under the assisted wiring scheme shall not exceed 400 per annum. This provision is to apply only to houses taking a supply of gas from the Corporation.

FRINGE ORDER.—The Corporation Electricity Committee has been granted a Fringe Order to supply premises in the rural districts of Brampton and Carlisle.

Continental.—POLAND.—According to a report issued recently, the sales of electrical energy of the Société de la Centrale Regionale du Bassin de Cracovie, of Cracow, amounted during 1929 to 30,516,937 kWh, as compared with 29,314,397 kWh in the preceding year, and 2,853,480 kWh in 1913. In order to meet the growing demand a new 12,500-kW turbo-generator set has been installed at the power station.

LUXEMBURG.—During the past year the Compagnie Luxembourgeoise d'Electricité extended its h.p. distribution system to the extent of nearly 43 miles, enabling a supply of power to be given to 26 additional communes, leaving only 69 small towns and villages in the company's area to be connected.

Coulsdon.—FREE WIRING SCHEME.—At a recent meeting of the Urban District Council Housing Committee, correspondence was submitted from the County of London Electric Supply Co., Ltd., in which the company expressed its willingness to undertake the free wiring of council houses on the Kenley and Coulsdon housing schemes, subject to 80 per cent. of the tenants being willing to take a constant supply of electricity. The Committee agreed in principle to the suggestion of the company and instructed the clerk to negotiate with the company upon the matter and to report thereon at the next meeting.

Dorchester.—LOANS.—The Corporation Lighting Committee is applying for sanction to loans of £500 for meters, and £500 for mains extensions.

East Grinstead.—POWER STATION EXTENSION.—The Urban District Council has decided to extend the plant at the generating station by the installation of an additional Diesel engine at a cost of £2,600.

Hampton.—STREET LIGHTING.—At a recent meeting of the Urban District Council General Purposes Committee it was decided to instruct the surveyor to present a report upon the capital expenditure which would be involved in substituting electricity for gas, and upon the annual cost on the maintenance supply as compared with the present system.

Hastings.—METERS.—The Corporation Electricity Committee is applying for sanction to a loan of a further sum of £10,000 for prospective expenditure on electricity meters.

LOANS SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £16,000 for mains; £4,000 for sub-station equipment; and £23,126 for mains in connection with an additional e.h.p. feeder to Bexhill.

New Zealand.—ARAPUNI HYDRO-ELECTRIC SCHEME.—The Arapuni hydro-electric plant on the Waikato river, the construction of which was to have been completed recently, has been closed in order to enable the engineers to ascertain the extent of a fracture which has occurred in the spillway. The examination involves the lowering of the lake reservoir which is 25 miles long, by some 15 ft. Meanwhile a stand-by plant will take over the Arapuni load. Apprehensions of a flood occurring have been allayed, but it is stated that owing to the mishap, the future usefulness of the Arapuni scheme is uncertain. After lowering the water level below the headrace, experts decided to proceed at once with the work of concreting the face of the falls below the spillway, where erosion has taken place.—*Reuter* (Auckland).

Having commenced the work of repairing the plant, the engineers now state that it will be necessary to concrete the whole headrace from the main dam to the spillway, a distance of about a mile, and also to concrete the cliff face of the falls below the spillway and construct a concrete floor at the base of the falls. This work would involve the closing of the Arapuni plant for many months and the cost would probably exceed £250,000. Commenting on this statement of the engineers, Mr. W. B. Taverner, Minister of Public Works and Transport, said that he would not come to any hasty decision in the matter. The problem presented extraordinary difficulties, and he was awaiting fuller information from the experts. —*Reuter* (Wellington).

Northern Ireland.—OMAGH (CO. TYRONE).—Following the inquiry held last month into the proposed electricity scheme for the town the Electricity Commissioners of Northern Ireland have confirmed their previous Order favouring the scheme put forward by the Urban District Council.

Petersfield.—PUBLIC LIGHTING AT BRAMSHOTT.—The Rural District Council has decided to apply for an Order enabling the Council to contract with the Aldershot Gas, Water and District Lighting Co., or any other electricity supply company, for a supply of electricity for public lighting at Bramshott.

Portsmouth.—MAINS EXTENSIONS.—Further extensions of mains in the districts outside the city have been decided upon by the Corporation Electricity Committee. An estimate of £3,600 has been submitted by the electrical engineer for the proposed extension to Hill Head, and this is to be carried out subject to guarantees as to consumption. The approved extensions are to Thorney Island, at an estimated cost of £1,650, and to North Hayling, at an estimated cost of £1,250, part of the latter line being carried overhead.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:

WIGAN.—Power: The present charges of 2d. per kWh for the first 500 kWh, 1½d. for second 500, 1½d. for next 1,000, and 1½d. for all over 2,000 kWh to be reduced to 2d. per kWh for the first 500 kWh, 1½d. for second 500, 1½d. for third 500, and 1½d. for next 1,000, and 1d. for all energy consumed in excess of 2,500 kWh.

TONBRIDGE.—Flat rate: Lighting: From 5½d. per kWh for the first 5,000 kWh, and 4½d. beyond, to 5d. and 4d., respectively. Heating: From 1½d. to 1¼d. per kWh. Two-part tariff fixed charge: Houses not exceeding £20 rateable value, 20 per cent.; over £20 rateable value, 20 per cent. for the first £20, and 10 per cent. on the remainder. The "unit" charge is to remain at 1d., except in houses where there are cookers, when the charge will be ¾d.

BURY ST. EDMUNDS.—Lighting: From 5½d. to 5d. per kWh.

DORCHESTER.—Lighting: First 2,500 kWh, 8d. per kWh; above 2,500 kWh, 7d. Power: 2d. per kWh.

DUDLEY.—Shropshire, Worcestershire & Staffordshire Electric Power Co. Lighting, up to 600 kWh per quarter: Surcharge reduced from 40 to 33⅓ per cent.; the factory premises surcharge is also reduced to 33⅓ per cent. Prepayment meter lighting: From 4½d. to 4d. per kWh. Power: From 1.4d. to 1½d. per kWh for consumption above 600 kWh.

READING.—Lighting flat rate: After the first 25 kWh in each of the summer quarters and after the first 75 kWh in each of the winter quarters, the charge to be reduced from 5d. to 4½d. per kWh.

St. Helens.—LOANS.—The Town Council has applied for sanction to a loan of £8,154 for a supply of electricity to Bold and part of Burtonwood area, and has received sanction to a loan of £48,150 for extensions to the generating station, made up as follows: Buildings, cooling tower tank, and foundations, £4,200; generating plant, £40,950; wooden superstructure for cooling tank, £3,000.

CHANGE-OVER SCHEME.—The Unemployment Grants Committee has approved for grant purposes the scheme for changing over the system of supply from d.c. to a.c., and the engineer has been instructed to proceed with the whole of the work.

Shetland Islands.—IMPROVEMENT SCHEMES.—Mr. William Adamson, Secretary of State for Scotland, paid a visit recently to Lerwick, where he conferred with the local authorities concerning improvement schemes, including the introduction of electric lighting and wireless communication with the Islands.

South Shields.—HOUSE-WIRING INSTALLATIONS.—The Corporation Electricity Committee has obtained sanction to the borrowing of £5,000 for house wiring installations with prepayment meters to be let on hire.

Spalding.—ASSISTED WIRING SCHEME.—The Urban District Council has applied for sanction to a loan of £1,000 for assisted wiring purposes.

Special Orders.—Application has been made to the Electricity Commissioners by Crompton Parkinson, Ltd., to amend the draft of a Special Order already applied for so as to include in the area of supply the parishes of Ingleton and Thornton-in-Lonsdale in the rural district of Settle.

The Electricity Commissioners have submitted to the Minister of Transport a Special Order authorising the Yorkshire Electric Power Co. to supply electricity in the district of Silsden.

Stoke-on-Trent.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sancton to the borrowing of £5,000 in connection with the supply to the Kingsway, Church Street and Copeland Street area; £3,300 for supply to Swan Lane housing area, Trent Vale; £1,050, for supply to additional houses on the Sutton estate, Trent Vale; £4,200 for change-over in the Kingsway, Church Street and Copeland Street area; and £1,000, for change-over in High Street area, Longton.

Swansea.—NEW POWER STATION.—The site for the erection of the new large power station to supply electricity in South-West England and South Wales has been chosen at Crymlyn

Burrows. The station will have an initial capacity of 60,000 kW and will be designed so that this can be increased to 240,000 kW. The cost of the new station will be about £3,000,000.

Walthamstow.—UNEMPLOYMENT SCHEME.—The Town Council has received from the Unemployment Grants Committee a grant towards approved expenditure not exceeding £112,233 in respect of laying underground mains in all uncabled roads in the district, and the equipment of sub-stations. The Electricity Commissioners have intimated that a section of the proposed works, estimated to cost £12,560, in the Woodford area, could not be regarded as sufficiently advanced in point of time to satisfy the relative conditions, and in consequence a grant will not be made for this portion of the scheme.

Warrington.—ADDITIONAL SUPPLY.—The Corporation Electricity Committee has received a letter from the Central Electricity Board with regard to its application for permission to install additional plant, intimating that the Board hoped to be in a position to obtain surplus supplies from beyond the borough, and to have the scheme in operation so as to provide sufficient for Warrington's demands for some years. The town clerk and engineer have been instructed to meet a representative of the Board and discuss the matter further.

EXTENSION OF SUPPLY AREA.—At a recent meeting of the Corporation Electricity Committee the town clerk submitted correspondence with the South-East Lancashire Electricity Advisory Board, from which it appeared that the Electricity Commissioners had suggested that the following areas should be added to the area of supply of the Electricity Department: (*a*) The township of Rixton-with-Clazebrook in the rural district of Warrington; (*b*) the parishes of Carrington and Partington and the part of the parish of Dunham Massey which is not within the area of supply of the Altrincham Electric Supply, Ltd., all within the rural district of Bucklow; and (*c*) a small part of the urban district of Altrincham which is outside the area of supply of the Altrincham company. The engineer was instructed to accept responsibility for the additional areas suggested, together with the areas of Cuerdley and Burtonwood.

Tramway and Railway Notes.

Australia.—PETROL-ELECTRIC TRAINS FOR VICTORIAN RAILWAYS.—The Victorian Railways Department has been conducting trials with a train of the petrol-electric type says the *Industrial Australian and Mining Standard*. The new petrol-electric cars are 58 ft. in length, and each has accommodation for 55 passengers. The weight of each car is 43 tons, and it is capable of drawing one or two trailers, each carrying about 80 passengers. A normal petrol-electric train will consist of a car and one trailer. Power is derived primarily from a petrol engine of 220 h.p. This engine operates an electric generator, which in turn drives two 140-h.p. electric motors coupled to the driving wheels. The new stock is being built at Newport. The first petrol-electric car cost approximately £14,000, including all equipment, but it is expected that later cars of the same model will be built at a lower cost. It is probable that these cars will soon be used on several of the main country lines where sleeping accommodation is not required.

TASMANIA.—The Hobart City Council is considering the establishment of a railless-car service between Elizabeth Street and Cornelian Bay, with a branch to Bowen Road.

Ayr.—TRACK RENEWAL AND TRAMCAR RENOVATION.—The Town Council has decided to relay a portion of the tramway track at a cost of £11,600 and to recondition six of its tramcars at an estimated cost of £1,066 per car.

Continental.—SWEDEN.—Both Chambers of the Swedish Riksdag have agreed to the Government proposals regarding preparatory measures for the electrification of the section of the State Railway between Stockholm, Malmo, and Tralleborg, with certain junction lines.

London.—NEW TRAMCARS.—The London County Council recently put into operation the first of a new fleet of 150 up-to-date tramcars which are to supersede vehicles which have fallen below modern standards of efficiency and comfort. The new cars will be constructed of metal throughout and have many improved features including improved ventilation, linoleum-covered floors and non-splintering glass; a new method will also to be used to illuminate the service numbers. The new vehicles will have greatly improved acceleration and hill-climbing ability; fifty of them will be employed on routes including the Dog Kennel Hill, East Dulwich, one of the steepest inclines in London.

TUBE STATIONS TO BE RECONSTRUCTED.—An announcement of the Underground Railways states that it is planned to substitute sub-surface stations after the pattern of the new Piccadilly Circus station for several of the old above-ground stations. As reported in the ELECTRICAL REVIEW of June 6th the first of the surface stations to be converted will be Leicester Square station, work on which will be commenced within the course of the next few weeks and will cost about £400,000. Similar stations will be constructed at Hyde Park Corner, Dover Street, Knightsbridge, and other stations on the Piccadilly line. The complete scheme of extensions and improvements planned is estimated to cost £13,000,000, which includes the cost of the extension of the tube from Finsbury Park to Cockfosters and from Hammersmith to Northfields, together with the enlarging of outlying stations and the conversion of the Central and West London stations into sub-surface stations. The extensions alone will cost about £8,000,000.

Manchester.—TRAMCAR ACCIDENT.—A Salford Corporation tramcar travelling between Whitefield and Manchester late last Friday night left the rails while rounding a sharp curve in Bury Old Road, near Heaton Park, and fell over on its side. One person was killed and 27 had to receive hospital attention.

Telegraph and Telephone Notes.

Malaya.—LONG-DISTANCE TELEPHONY.—Agreement has at last been reached with respect to the provision of long-distance telephony between Singapore and the rest of Malaya, the scheme having been held up hitherto by a difference of opinion between the Straits and F.M.S. Governments as to the apportionment of the cost. According to *Eastern Engineering*, of the $1,000,000 which appears in the Federal estimates for telegraph and telephone development, $400,000 has been allocated for carrier-current telephony between the F.M.S. and the Straits, and $300,000 included in the Straits estimates for the same purpose.

South America.—GERMAN TELEGRAPH INTERESTS.—At the annual meeting of the German-Atlantic Telegraph Company it was mentioned that the company's participation in the Compania Telegrafico-Telefonica del Plata had recently been disposed of to the Siemens & Halske Company. The arrangements made by the latter would guarantee to German cable and radio traffic a connection with the telephone and telegraph company in South America, which is worked by the Siemens group.

Telephony versus Telegraphy.—COMPARATIVE FIGURES.—The ascendancy which, on account of its speed, convenience, and economy, telephony is assuming over telegraphy is indicated by statistics just published by the controller of the American Telephone & Telegraph Company. In Canada, which this year holds the record for the use of the telephone, each individual holds an average of 241 telephone conversations per year, but in two years sends only three telegrams. The Americans, each of whom on the average telephones 230.7 times a year, send only 1.9 telegrams each. New Zealanders, the third most talkative people on the telephone, with 209.1 conversations apiece per annum, are easily first in using telegraphy, for each New Zealander also sends 4.7 telegrams a year. The Danes, who use the telephone more than any other European nation, with 143.5 conversations per head every year, send just over one telegram every two years. Each Japanese averages 56 telephone calls a year, but sends only 0.7 of a telegram. Germans, who use the telephone 38.1 times each per year, send one telegram in two years, while Englishmen use the telephone only 30.6 times, but send 1.2 telegrams in the same time.

Wireless at Sea.—INTERESTING INNOVATION.—A new use for wireless telephony at sea is foreshadowed by the announcement that the Marconi equipment that was installed on the White Star Co.'s liner *Britannic* for her trials has been transferred to a newly-built steamer for a similar purpose. So valuable did the equipment prove to be for passing immediate information between the ship while she was on trial in the River Clyde estuary and the yards of her builders at Belfast that Messrs. Harland and Wolff applied to the Post Office for permission for similar facilities on board the *Innisfallen*, which they built for the City of Cork Steam Packet Company. Sanction has now been given by the Post Office, and the success of the innovation has been such that the installation of similar equipment may become an important factor in ships' trials in future. The equipment was installed by the Marconi International Marine Communication Co., Ltd., and is the type YC.4 combined transmitter and receiver having a power of 500 watts.

Photo-telegraphy.—EXPERIMENT ON TRANSATLANTIC VESSEL.—A photo-radio receiver has been installed on the liner *America* and will be used continuously throughout the vessel's return voyage from the U.S.A. to Hamburg, Germany, according to the Radio Corporation of America. A regular photo-radio service will supplement, but not supplant, existing ship newspapers. The apparatus is expected to be effective within a radius of 3,500 miles.—*Reuter* (New York).

Radio Notes.

Czecho-Slovakia.—LICENCES.—Some 25 per cent. of the country's population utilises the service, the number of licences registered being 284,432; the proportion of crystal users is 67 per cent.

New Zealand.—LICENCES.—Of the total licences in force, which number 53,183, some 51,588 are receiving, 202 transmitting, 213 free, 2,176 dealers', and four special experimenters'. It is estimated that the company is receiving about £65,000 per annum from licence fees.

U.S.A.—LISTENERS' TAX.—For the first time in American radio history a tax is to be levied on wireless receivers, South Carolina being the State to introduce the daring imposition. The tax amounts to fifty cents a year (about 2s.) on sets valued at fifty dollars, with proportionate increases according to value. The *Wireless World* reports that the proceeds are to be handed over to the hospitals.

India.—NEW ADVISORY COMMITTEE.—The *personnel* of the new Indian Central Broadcasting Advisory Committee was gazetted on June 14th, says *The Times*. It will consist of the member of the Government of India for Industries and Labour (Sir J. W. Bhore), who will be chairman; two officials from that Department; two non-official Indian members of the Legislative Assembly from Bombay and Calcutta respectively; and two non-official Englishmen from Bombay and Calcutta. The duties of the Committee will be to advise the Industries and Labour Department, which has had charge of the broadcasting service since it was bought by the State last March. When the Committee meets at Simla on June 23rd it will review the existing broadcasting system, consider the possibilities of improvement, and examine means of increasing its revenue. Following the example of the defunct Indian Broadcasting Corporation, the Government of India took authority from the Legislature for the expenditure of Rs.267,000 (about £20,000) for working expenses during the year, which began on April 1st. This is a very small sum, for in the whole of the sub-continent there are fewer than 10,000 licences.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 9th. City Council. Supply of totally-enclosed metal-clad switchgear. (B.X. 6401.)*
Posts and Telegraphs Department. August 19th. Telephone jacks. (B.X. 6477.)

Bedford.—July 10th. Electricity Department. Coal handling plant and extension of sidings at the power station. (See this issue.)

Belfast.—July 5th. Electricity Department. H.p. switchgear, transformer kiosks with h.p. and l.p. switchgear, and static transformers. (June 6th.)

Birmingham.—July 1st. Asylums Committee. Installation of complete system of electric lighting and power supply at Uffcolme Mental Hospital, King's Heath. Specification (deposit £5) from H. H. Humphries, city engineer, Council House.

Cardiff.—July 1st. Public Health Department. H.p. and l.p. switchboards, transformers, battery and charging plant for Llandough hospital. (June 6th.)

Carlisle.—July 11th. Electricity Committee. 11,000-V overhead transmission line together with certain pole-mounted switchgear. (See this issue.)

Chile.—SANTIAGO.—July 29th. State Railways. Electric clocks. (B.X. 6472.)*

Cheadle and Gatley.—July 8th. Urban District Council Electricity Department. 250-kVA oil-cooled transformer. (See this issue.)

Croydon.—July 3rd. Electricity Department. 25,000 tons of coal. (See this issue.)

Dundee.—June 25th. Electricity Department. E.h.p. switchgear and bus-bar reactors in the Caroline Port power station. (June 6th.)

Egypt.—CAIRO.—July 26th. Ministry of the Interior. Supply and erection of a cooling tower for the electric power station at Assiout. (A.X. 9627.)*

TOR QUARANTINE.—June 30th. Ministry of Public Works. Generating unit with accessories, motors, and erection of transmission lines and cordon lighting round a camp. (B.X. 6466.)*

Farnworth.—July 23rd. Urban District Council. L.p. disconnecting boxes, frames and covers and distribution pillars. (See this issue.)

Heston and Isleworth.—July 4th. Electricity Department. One 3,000-kVA transformer and e.h.p. switchgear and interconnecting cables. (See this issue.)

India.—July 16th. India Store Department. Transformers, with motors and switchgear. (See this issue.)

Kilkeel.—July 2nd. Rural District Council. Oil engine, fuel tank, and accessories; also generator, booster, and switchgear. (See this issue.)

Leeds.—June 23rd. Public Assistance Committee. Electric lamps. Specifications from H. Fieldhouse, Public Assistance Officer, 11, South Parade.

June 26th. Libraries and Arts Committee. Electric lighting installation at Hunslet library. Specifications from J. E. Acfield, city engineer, Municipal Buildings.

London.—CENTRAL ELECTRICITY BOARD.—June 23rd. Supply, delivery, and erection of 66,000-V and other cables for the Mid-East England Electricity Scheme, 1929. (May 23rd.)
June 27th. Pilot cables for the Central England Electricity Scheme, 1928. (June 6th.)
June 30th. Metering equipment in the area of the Central England Electricity Scheme, 1928. (May 30th.)
33,000-V and other cables for the South-East England Electricity Scheme, 1927. (June 6th.)
July 28th. 132-kV transmission line crossing of the River Thames for the South-East England Electricity Scheme, 1927. (June 13th.)

METROPOLITAN WATER BOARD.—June 30th. Two 120-kW generators, switchboard, piping, &c., at Deptford pumping station. Forms of tender, specification and drawing may be inspected at the chief engineer's department (Room 173), 173, Rosebery Avenue, E.C.1.

BETHNAL GREEN.—July 3rd. Borough Council. Electric light installation at a block of tenement dwellings. (See this issue.)

Louth.—July 4th. Town Council. Electric lighting and power installation at the Town Hall. (See this issue.)

Manchester.—June 27th. Electricity Committee. Annual contract for 3-phase, 6,600-V switchgear. Supervisory control gear, Cumberland Street sub-station. (June 6th.)

Newcastle-upon-Tyne.—July 14th. Newcastle-upon-Tyne Electric Supply Co., Ltd. Complete boiler-house equipment for the Dunston power station. (June 13th.)

New Zealand.—WELLINGTON.—Public Works Department. July 1st. 110-kV suspension insulators for the Waitaki Power Scheme. (B.X. 6443.)*
August 12th. 11-kV metal-clad switchgear and accessories for Mangahao. (B.X. 6455.)*
August 19th. Supply and delivery of three single-phase transformers for the Penrose sub-station. (B.X. 6427.)
October 7th. 110-kV and 50-kV switchgear, protective system and steelwork for Arapuni Electric Power Scheme. (B.X. 6450 and 6451.)*
Post and Telegraph Department. June 24th. Telephone cords. (B.X. 6484.)*

Plymouth.—July 10th. Corporation. Two water-tube boilers with chimney, &c. (See this issue.)

Salford.—June 25th. Electricity Department. One 1,000-kVA step down Scott-connected transformer bank, ratio 6,600 V, three-phase, 50 cycles, to 3,130 V, two-phase. Specifications from city electrical engineer, Electricity Department, Frederick Road.
June 30th. City Council. Electric lighting installation for new nurses' home, Hope Hospital. Specifications (deposit £2 2s.), from Public Health Department, 143, Regent Road, Salford.

South Africa.—CAPE TOWN.—June 25th. Electricity Department. Supply of single-phase transformers. (B.X. 6378.)*

JOHANNESBURG.—Railways and Harbours. July 28th. Twenty-eight electric lifts for the new railway building, Johannesburg. (A.X. 9623.)*

August 11th. Thirteen four-ton electrically-driven portal jib cranes for Table Bay Harbour. (B.X. 9683.)*

June 26th. Municipal Council. Electricity meters and time switches. (B.X. 6449.)*

Sunderland.—July 7th. Electricity Department. Supply for 12 months ending September 30th, 1931, of cable, wire, meters and lamps. (June 6th.)

Warsop and Blackwell.—June 24th. Rural District Council. Electric motors and equipment in duplicate at main pumping house, Warsop (contract No. 4); electric mains and equipment in duplicate at booster station (contract No. 7). Specifications (deposit £2 2s. each contract) from Elliott and Westwick, Gilcroft Chambers, Church Lane, Mansfield.

Westmeath.—June 26th. County Council. Electrical installations at County Buildings, Mullingar, and courthouses at Mullingar, Athlone, Moate and Kilbeggan. Specifications from Messrs. J. P. Tierney & Co., consulting engineers, 44, Kildare Street, Dublin.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Australia.—SYDNEY (N.S.W.).—Municipal Council.
Oil switch panels, l.p., for sub-stations.—Metropolitan-Vickers (Australia) Pty., Ltd.
Automatic oil, metal-clad, outdoor h.p. switch units and 12 trifurcating boxes for l.c. cables (£8,259).—Standard Waygood, Ltd.

MELBOURNE.—City Council.
A.c. motors.—Australian General Electric Co., Ltd. (£2,032); Noyes Bros. (Melb.) Pty., Ltd. (£4,255); McColl Electric Works (£601).
—*Tenders.*

Bedford.—Electricity Committee. Accepted:—
100-kVA transformer (£90), and oil switch (£84).—Marion and Foulger.
Six 3-phase motors and starters (£151).—Gabriel Wade and English, Ltd.

Bexley.—Urban District Council. Accepted:—
Cables for one year (£5,816).—Felten & Guilleaume (Cologne).
The lowest British tender was £7,741, less 2½ per cent.

Blackburn.—Electricity Department. Accepted:—
Gasfilled and vacuum lamps for one year.—British Thomson-Houston Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
800 yards h.p. cable (£202).—Macintosh Cable Co., Ltd.
Transformer sub-station and equipment (£242).—Yorkshire Switchgear & Engineering Co., Ltd.
Spare 150-kVA transformer (£120).—Brush Electrical Engineering Co., Ltd.

East Ham.—Electricity Committee. Recommended:—
Electric lift for new offices (£167).—Evans Lifts, Ltd.
Switchgear (£11,450).—A. Reyrolle & Co., Ltd.
Feeder switch (£238).—British Brown-Boveri Co., Ltd.

Glasgow.—Health Committee. Accepted:—
Electrical fittings, &c.—General Electric Co., Ltd.

London.—SHOREDITCH.—Electricity Committee. Accepted:
2,500-kW feeder equipment (£1,157).—British Thomson-Houston Co., Ltd.
Extension feeder truck cubicle to existing e.h.p. switchboard at Evelyn Street sub-station (£245).—General Electric Co., Ltd.

Manchester.—Central Purchasing Committee. Accepted:—
Electric lamps.—Berry's Electric (1928), Ltd.; "Z" Electric Lamp & Supplies, Ltd.; Downes & Davies, Ltd.; Drake & Gorham Wholesale, Ltd.; S. Gratrix, Junior and Bro., Ltd.; Baxendale & Co., Ltd.; Falk, Stadelmann & Co., Ltd.; Sloan Electrical Co., Ltd.; F. G. Ride & Co.; Underwood (Manchester), Ltd.; J. C. White & Co., Ltd.; W. E. Beardsall & Co., Ltd.; Wholesale Fittings Co., Ltd.; R. O'Brien & Co.; and Hirst, Ibbetson & Taylor, Ltd.
The chief engineer and manager has been ordered to exercise the option under contracts with the following firms for the purchase of transformers required during the period ending January 9th, 1931:—Crompton Parkinson, Ltd.; English Electric Co., Ltd.; Ferranti, Ltd.; C. A. Parsons & Co., Ltd.

Accepted:—
420-V switchgear, Barton power station.—Metropolitan Vickers Electrical Co., Ltd.
Rebuilding of chimneys, Barton power station.—Newton, Chambers & Co., Ltd.
6,600-V switchgear, Oldham Road sub-station.—A. Reyrolle and Co., Ltd.
Education Committee. Accepted:—
Electrical installation, Openshaw school clinic.—Bertram Thomas.
Electrical installation, Gorton new special school.—W. A. Shaw.

Portsmouth.—Town Council. Accepted:—
Installation of automatic traffic signals at Fratton Bridge (£140).—Forest City Electric Co., Ltd.

Forthcoming Events.

Association of Mining Electrical Engineers.—June 24th to 28th. Annual convention in London.

Electrical Contractors' Association.—Llandudno. June 25th to 27th. Annual convention.

Physical Society.—Thursday, June 26th. Imperial College of Science, South Kensington, S.W.7. 5 p.m. Short papers.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

ROSBENITE varnish.
RELIANCE & CORNHILL bake-ovens, ranges, hotplates, &c.
DELLITE insulation.

Notes.

Dual-purpose Refrigerating Plant.

The use of an electrically-driven refrigerating plant for heating a building in winter and cooling it in summer is the subject of an article by Mr. Emile Guarini in the *Cold Storage and Produce Review*. The principle is similar to that put forward by Mr. T. G. N. Haldane in his paper before the I.E.E. (ELECTRICAL REVIEW, December 27th, 1929). Mr. Guarini states that a small automatic household refrigerator can cool a flat of 400 cub. metres at a cost of 0.43 Belgian francs per cub. metre per hour, *i.e.*, for the whole flat and 10 hours working at a total cost of 17 Belgian francs, including the amortisation and interest on the capital invested.

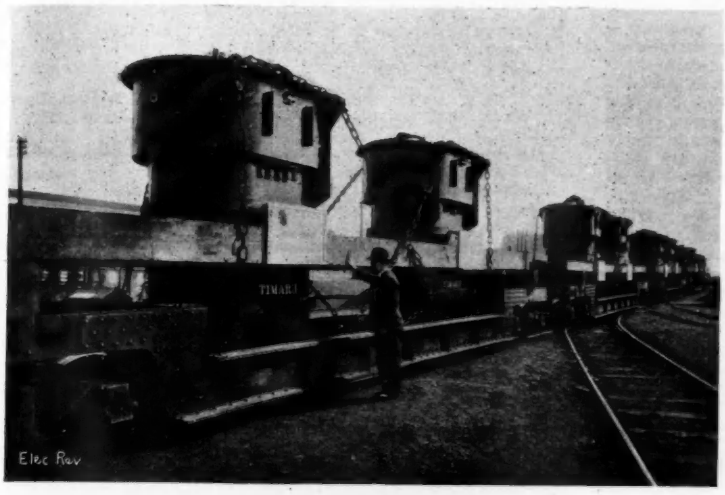
For Brussels with coal at 40 centimes the kilogramme, gas at 1 Belgian franc the cub. metre, and electric current at 1 Belgian franc the kWh, the following costs of heating per 100 cub. metres, and per hour in Belgian francs have been established: direct electric heat, 2.30; gas heating, 1.0; central heating, 0.20; refrigerating machine, 0.12 to 0.64.

In Italy with electric current at 0.20 lire per kWh, coal at 0.40 lire per kilogramme, and estimating that the kWh gives on an average 4,000 cal., *i.e.*, as much practically as 1 kilogramme of coal, utilised in central heating with an efficiency of 50 per cent., the following are the comparative costs for heating per 100 cub. metres and per hour, in Italian lira:—Gas (1 cub. metre per hour, and 100 cub. metres of air) 1.0; direct electric current heating (43 cub. metres per kWh), 0.46; central heating, 0.20; refrigerating machine, 0.16.

The heat may be extracted from the external air or from the water, either by simply cooling the latter, or by cooling and freezing it. By cooling and freezing a cub. metre of water, taken at an initial temperature of 10 deg. C., one obtains 90,000 cal., sufficient to heat a small house or a large flat, *i.e.*, the equivalent practically of 25 kilogrammes of coal, worth 10 lira in Italy, and 10 francs in Belgium. The heating could be effected preferably through batteries of ribbed radiators provided with electric ventilators, or else through ordinary radiators. If ordinary radiators are used, it is necessary to have large surfaces for heating, with a fluid at 20 deg. C. to 25 deg. C., instead of 80 deg. C. to 90 deg. C., as is usually employed with hot water central heating.

Large Power Transformers for Waitaki.

Among recent important developments in New Zealand is the electric power scheme at Waitaki which is being carried out to the plans of the Public Works Department. A part of this installation includes seven 5,500-kVA single-phase transformers of special design manufactured by the British Thomson-Houston Co., Ltd., and the above illustration shows a part of a railway train, prior to its departure from Rugby, loaded with the seven transformers. The shipment had a net load of over 90 tons, the weight of each transformer amounting to about 13 tons. The transformers, which are of the oil-immersed water-cooled outdoor type, will form the initial installation of two 16,500-kVA three-phase banks, with one spare, at the Waitaki power station, where ultimately the transformer installation will consist of five 16,500-kVA banks. The alternators will be connected to the banks of transformers and the pressure stepped up from 11,000 volts to 110,000 volts, three-phase, 50 cycles, for feeding the transmission lines. All the transformers will be delta-connected on the primary or 11,000-volt side, and star-connected on the high-voltage side, with the neutral point solidly earthed. An interesting feature is that the 110,000-volt transformer bushings are interchangeable with those on the oil-immersed circuit breakers, the latter being of similar construction to the 132,000-volt oil-immersed circuit breakers supplied by the B.T.H. Co. for the Scottish grid scheme. In addition to the oil-immersed circuit breakers, the switchgear for the Waitaki scheme includes a metering desk and an indoor control board with voltage regulators and engine-room telegraphs.



A Train of Transformers.

Recovery of Metals by Electrolysis.

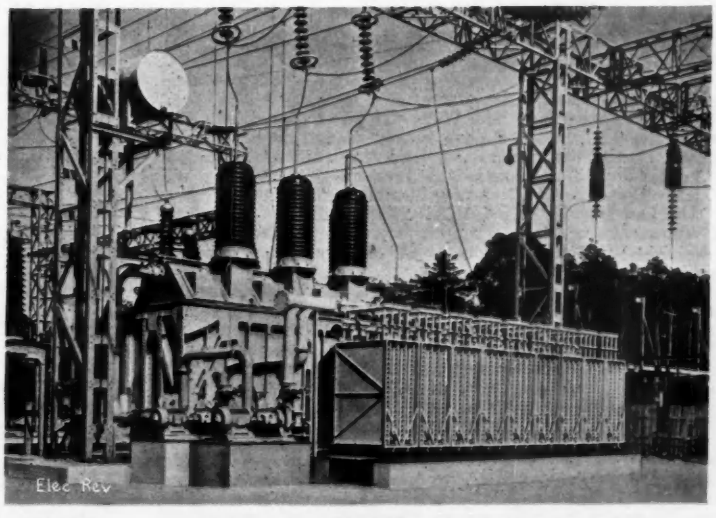
An industry which seems to be somewhat neglected in England is the recovery of metals from various alloys when in the form of waste or scrap, for we are usually satisfied with the extraction of what may be handled with the greatest facility. In Germany tin has been recovered commercially for many years from scrap tinned sheet, and the remarks made by Professor O. Scarpa in a paper read before the Société Française des Electriciens in Paris are of particular value. In France the recuperation of metals as an industry is practically non-existent, for the firms capable of extracting only copper, gold, and silver, from chemical residues may easily be counted on the fingers of one hand, notwithstanding that more than 90 per cent. of the copper France requires has to be imported. The result is that residues in France are generally sent abroad for treatment, usually to Germany. Professor O. Scarpa, of the Royal Polytechnic School, of Milan, draws attention to the importance of the recuperation of copper and tin from bronze scrap. He deals with the difficulties encountered with the usual electrolytic methods and gives some details of his system employed in Italy since 1923. He insists particularly on the importance of maintaining constant the composition and temperature of the electrolite, and of the treatment of the residues. He claims to be able to extract electrolytically copper and tin in perfect purity, and recover 86 per cent. of the copper, 7.5 per cent. tin, 4.2 per cent. zinc, 2 per cent. phosphor, and 0.1 per cent. of the iron and antimony. The bronze is first melted into plates about 1 metre square and 3 cm. thick, 16 of which are suspended, as anodes, with 15 cathodes made of thin sheets of electrolytic copper, in large baths containing a hot electrolyte consisting of sulphate of copper and sulphuric acid. The copper is deposited on the cathodes up to about 1 cm. in thickness, and the final weight is about 40 kg. The voltage applied is generally about 0.4 V and the consumption of electricity is 0.665 kWh per kg of copper, of 99.97 per cent. purity, produced. Nearly all the tin goes into the residual mud, from which it is recovered for a consumption of about 10 kWh per kg. of tin. When in the mud the tin is in the form of stannic or metastannic acid, and to deal with it the author has developed two methods: (1) mechanical and chemical purification, thermal reduction of the oxides, and treatment of the resulting alloy by electrolysis; (2) treatment of the mud by hot solutions of soda, and, when purified chemically from its lead, zinc, and antimony, the solution of stannate of soda is treated electrolytically between iron anodes and thin sheet-tin cathodes. The author claims that the treatment of scrap bronze, even when very high in impurities, has now been completely resolved electro-chemically. The principal difficulty in founding an industry of this character is the capital required, on account of the price of copper and bronze and the quantities of these metals which are necessary for the electrolytic baths. For a factory to treat four tons of bronze per day a capital of two million French francs is necessary for the electrical and chemical installations, and a further three millions is required for the metal in circulation and in reserve. Nevertheless, the profit to be obtained is very attractive when the work is carried out efficiently and the purchase and sale of the metals are effected with commercial ability.

It is believed that if the claims of Prof. Scarpa can be maintained in practice, there will be ample scope for the process on the Continent.

A Large Outdoor Transformer Installation.

The Siemens-Schuckertwerke Gesellschaft has recently completed a contract for fourteen 60,000-kVA 220/110-kV transformers for the Rhenish-Westphalian Electric Power Co., of Essen. The transformers are star-star connected, and on the lower-voltage side the voltage can be reduced to 55 kV by means of connections under the cover. By means of delta connections it is also possible to step down the pressure to 63.5 and 31.75 kV, while there is a tertiary delta-connected winding by means of which 18,000 kVA can be delivered at 10 kV. The no-load losses of the transformers amount to 157 kW, and the losses in the windings under full load are 490 kW. The stray voltage equals 13 per cent. Including the oil chamber and oil, the transformers each weigh 175 tons, while the weight of the oil preserver, with oil, is 3½ tons.

For the cooling of the transformers a compressed-air installation capable of delivering about 7,000 cu. ft. of air per min. at 25 mm. water gauge pressure has been provided, each transformer having nine cooling elements, as is shown below. Three of the elements are connected up to a cooling block supplied with air through an air chamber at the rate of about 35 cu. ft. per second by a fan driven at 145 r.p.m. by a 10-kW motor. The cooling plant is mounted on rollers, so that any part requiring attention can be quickly handled. The heated oil from the transformers is delivered through the cooling elements by means of two centrifugal pumps which, at a speed of 730 r.p.m., are capable of delivering 990 gallons per minute.



60,000-kVA Outdoor Compressed-air Cooled Transformer.

Smoke and Health.

In the course of a lecture delivered before the Manchester College of Technology, Dr. Taylor (assistant M.C.H., Manchester) states that practically all the smoke nuisance from which people suffer is due to the use of bituminous coal for heating purposes, both in the factory furnace and in the domestic hearth. It is composed of carbon, hydrocarbons and ash (*i.e.*, volatile matter and coke) with a varying amount of sulphur and moisture. Completely burnt, these constituents are converted into carbon dioxide, water and sulphur dioxide, the ash alone remaining. In this state the compounds are comparatively harmless, but complete combustion is almost a practical impossibility in the fireplace and furnace as designed to-day. With imperfect combustion, a portion of the volatile matter is distilled off which separates out into sooty matter forming smoke. This soot consists of carbon mixed with tarry matter and sulphur acids, mixtures known to science to be inimical to health.

To-day in Manchester 3,000,000 tons of coal are burned anually, of which three-quarters of a million are used for domestic purposes. Eleven hundred factory chimneys and one hundred and fifty thousand houses are almost continuously discharging into the air the products of the incomplete combustion of these millions of tons of coal. As a result 20,000 tons of solid matter fall annually in the city area, and tar and acids to the amount of 75,000 and 200,000 gal., respectively. And this in spite of the fact that during the last 30 years the industrial smoke emission in the city has been reduced by approximately 75 per cent. Man consumes seven times as much air by weight as he does food and water daily.

As a cause of infant mortality a smoky and dusty atmosphere transcends all other influences. Roughly 1/12th of all the deaths in England and Wales are due to respiratory diseases. In Manchester the respiratory death rate is twice as great. Again, for all rural England the infantile death rate for 1928 due to pneumonia and bronchitis was 8.8, for the County Boroughs 16.27, and for Manchester 23.16.

The fogs peculiar to industrial cities are due to smoke and not to natural causes. Within a period of 40 years fogs have diminished in Manchester by 70 per cent., a change which is obviously not one of climate.

Manchester, compared with Timperley, situated to the south-west of Manchester within 8 miles of the centre of the city, receives on an average only 55 per cent. of the light received by Timperley. The prevailing winds are from the south-west. When the winds are from the north, however, the light incidence is completely reversed—a clear indication that it is the smoke and not the incidence of natural mist that causes black fog.

It has been found that there is a large accumulation of sulphur acids in the air during fogs. On a clear day the amount of SO_2 varies from 1 to 3 mgm. per cu. ft.; on a hazy day, 3 to 6 mgm. per cu. ft.; on a foggy day, 8 to 30 mgm. per cu. ft.; and it has been proved that as the fog continues the amount of SO_2 markedly increases, the fog and smoke acting as a blanket which prevents the free diffusion of these acids.

Tars and mineral oils produce cancer, and there is an appreciably greater occurrence of cancer of the thorax in places where the atmosphere is smoke-laden. But there are other conditions for which this blanket of smoke is responsible, not on account of its irritating constituent soot, but on account of its cutting off of the sun's rays, particularly the ultra-violet rays. Recent researches into the cause, prevention and cure of rickets have shown that the diseased calcification of the growing bones results from (*a*) a diet deficient in anti-rachitic substance, and/or (*b*) lack of ultra-violet rays—rays on the near side of the violet band in the visible spectrum.

In anæmia bloodlessness may be local or general, and of the latter type there is one—chlorosis—definitely attributed to lack of sunshine. It is most common among the ill-fed, overworked girls of large industrial towns, who are confined all day in close, badly-lighted rooms, and is not often found in country-bred girls.

Appointments Vacant.

Meter superintendent for the Perak River Hydro-Electric Power Co., Ltd.

Plumber jointer for Harwich Electricity Department.

Junior assistant for Distribution Department of Aldershot Gas, Water and District Lighting Company.

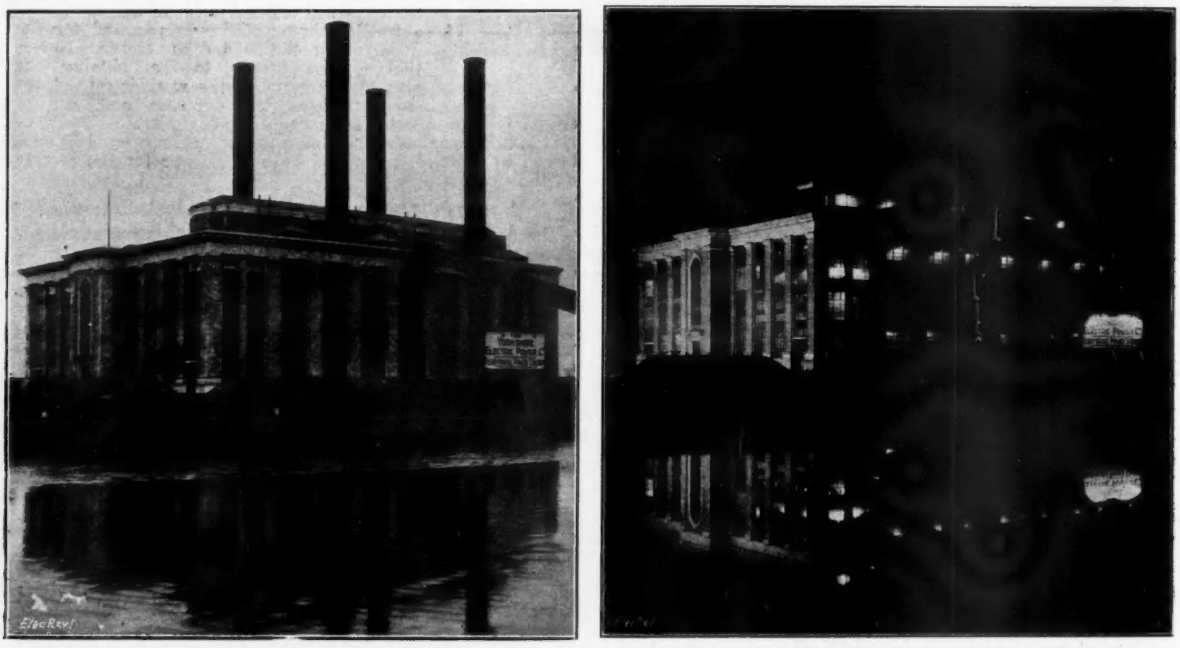
Plumber-jointer for Pudsey Electricity Department.

Mains assistant for Watford Electricity Department.

District superintendents for the Ayrshire Electricity Board. (See our advertisement pages to-day.)

Diesel Locomotives for Siam.

The Siamese State Railways have placed orders for six Diesel-electric railway locomotives of 450 h.p. each with a Swiss firm, and also for six of 900 h.p. and one of 1,400 h.p. with a firm in Denmark. Wood is the fuel used by the present steam locomotives, and it is calculated that the 900-h.p. Diesels will be able to improve on the present running time between Bangkok and Padang Besar by at least three hours, says *Eastern Engineering*. Presumably the smaller Diesels from Switzerland will be utilised for local traffic.



Day and Night (Floodlighted) views of the Ferrybridge Power Station of the Yorkshire Electric Power Co.

Fatality.

An inquest was held at Newark on June 11th on Charles Edward Francis, a priest at Helham Theological College, who received fatal injuries by falling from an overhead transmission-line mast. Evidence was given that the mast, which carried a 3,000-V line, was unprotected, had no warning notice attached, and had bolts projecting from its sides like the steps of a ladder. The coroner described the mast as offering an invitation to someone to climb it. The authorities should have seen that some protection was made round the mast. Medical evidence attributed death to a fractured skull caused by a fall, the result of an electric shock, and a verdict was returned accordingly.

Engineering and Financial Statistics, 1928-29.

The Electricity Commissioners have issued a new volume of their Return of Engineering and Financial Statistics relating to Authorised Undertakers in Great Britain. This publication covers the year ended March 31st, 1929, for public authority undertakings, and December 31st, 1928, for company undertakings. It is obtainable from H.M. Stationery Office, Kingsway, London, W.C.2, at 15s. net.

Special Libraries and Librarianship.

Many of the "Special Libraries" which have been established during recent years consist largely of periodicals and other records of the latest research, and they form important organs in the research departments and information bureaux attached to large technical and industrial concerns, as well as to scientific and other learned societies. To train competent librarians to run them is an urgent problem which has been anxiously considered by the Association of Special Libraries and Information Bureaux and also by the School of Librarianship at University College, London. The School has just prepared a scheme which has been passed by the Senate of the University of London to enable graduates in Science to receive a suitable course of training in one session, and attain the Diploma of Librarianship on conditions similar to those allowed to other University graduates. The present curriculum stands good for every type of librarian, but certain alternatives have now been introduced for the benefit of those who wish to become "special librarians." The separate subjects of library organisation and library routine have been modified and combined into the new subject, library economy; a new subject, "Special Library Services," dealing with the point of view and the scope of special libraries and information bureaux, has been introduced.

We are interested to learn from the Association of Special Libraries and Information Bureaux of the formation by the Association of a Panel of expert translators. Those who require the services of a translator often experience difficulty in finding one who has both a knowledge of the language and also of the special subject concerned, and it was with the object of overcoming this difficulty that the Council of the Association recently appointed a Committee to prepare a scheme for establishing a Panel of translators having both linguistic and technical qualifications, the part taken by the Association being to act as a connecting link between the translator and the user. Names of approved qualified persons are now being registered under the scheme adopted, and those who are interested, in either capacity, are invtied to write for particulars to the Secretary, Association of Special Libraries and Information Bureaux, 26, Bedford Square, London, W.C.1. Whilst the panel is intended to consist primarily of approved individual translators, it is hoped that commercial translating bureaux will apply for registration if they are prepared to satisfy the Association of their ability to offer sufficiently high-grade service.

Educational.

The entrance examinations for the award of "British Empire Scholarships" in the Faculty of Engineering, Loughborough College, have now been completed. The scholarships are tenable at Loughborough for the full period of the diploma course, and the Governors of the College have approved the following awards for 1930: Howell, J. C., Devonport High School; Whitehead, J. R., Sutton Coldfield Grammar School; Noble, N. E. D., Wellington College; West, Fred, Swanwick Hall School; Cox, Cyril C., Loughborough Junior College. R. J. Gaul, of Plumtree, South Rhodesia, has been recommended for a present scholarship which will be vacant in September next. The scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum. Applications were received from a large number of the Public and Secondary Schools in England, South Africa, Rhodesia, Australia, Palestine, India, and the Federated Malay States.

Large Extensions Sanctioned.

According to the *Financial Times* the Electricity Commissioners have sanctioned generating plant extensions totalling 390,000 kW. The extensions have been granted as follows: Barking (County of London Electric Supply Co.), 150,000 kW; Dunston "B" (Newcastle-upon-Tyne Electric Supply Co.), 150,000 kW; Brimsdown (North Metropolitan Electric Power Supply Co.), 50,000 kW; and London County Council, 40,000 kW. The total extensions will mean an expenditure of rather more than £4,000,000, all of which will go to British firms.

The addition to the County of London Electric Supply Co.'s station will bring the capacity up to 390,000 kW, and make Barking, it is claimed, the biggest generating station in the British Empire.

It is interesting to note that operating results obtained recently at the Barton power station of the Manchester Corporation have been such as to make it one of the most efficient generating stations in the world. The sanctioning of the extensions is regarded as an indication of the intention of the Electricity Commissioners to accelerate electrical development and assist the labour situation in the allied industries.

Institution of Electrical Engineers.

PREMIUM AWARDS.—The Council of the Institution has awarded the following premiums for papers read during the 1929-30 session:—

Meter and Instrument Section.—Silvanus Thompson premium to Messrs. E. H. Rayner, W. G. Standring, R. Davis, and G. W. Bowdler, and a premium to Messrs. A. E. Moore and W. T. Slater.

Students' Premiums to Mr. E. W. Connon, Messrs. J. C. Emerson and J. W. Moffat, Mr. L. E. C. Hughes, Mr. C. S. T. Paul, Mr. W. G. Thompson, Mr. C. H. Bradbury, and Mr. S. M. Lejeune. The students' prize of £10 offered by the Council for the best paper on "The Relations between Economics and Engineering" submitted by a student, or graduate under the age of 28, during the session has been awarded jointly to Mr. V. A. H. Clements and Mr. A. K. Robinson, the amount of the prize being divided equally between them.

CONVERSAZIONE.—The annual conversazione of the Institution was held as usual at the Natural History Museum, South Kensington, London, on June 12th. Colonel Sir Thomas F. Purves, O.B.E. (president) and Lady Purves, supported by members of the Council, received some 1,600 members and guests (about 250 less than last year) after which a trumpet call sounded by a Royal Engineer bandsman proclaimed silence for the president to deliver a felicitous address, the text of which is as follows:—"The President and Council of the Institution of Electrical Engineers desire to convey their heartiest congratulations to its esteemed Past-President, Colonel Rookes Evelyn Bell Crompton, on the occasion of his eighty-fifth birthday, on May 31st, 1930, and cordially wish him *ad multos annos*. His pioneer work in the advancement of electrical science and engineering and their applications, which is universally recognised, entitles him in the fullest degree to the respect and admiration of electrical engineers. As a mark of appreciation of the great services rendered by Colonel Crompton to the electrical engineering profession during his 50 years' membership of the Institution he was elected one of its honorary members in 1923 and was awarded its Faraday Medal in 1926. Witness our hands and seal at Westminster this twenty-ninth day of May, 1930. (Sgd.) T. F. PURVES, President; W. M. MORDEY, Member of Council; P. F. ROWELL, Secretary." Light refreshments were served throughout the evening. A programme of music was performed in the central hall by the string band of the Royal Engineers, while a vocal and instrumental concert in the reptile gallery was contributed to by the Salisbury Singers, the Misses Hetty Bolton and Sylva van Dyck, and Messrs. Robert Easton, Melsa, and E. Brightwell (accompanist).

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. G. H. Lake has been recommended for appointment as chief engineer and general manager of the Nottingham electricity undertaking at a salary of £1,750 per annum, in the place of Mr. H. Talbot who is retiring after 40 years' service with the Corporation, having been the city's first electrical engineer. Mr. Lake has been with the Derby undertaking for 30 years and was appointed chief electrical engineer in 1926. He is 49 years of age. There were 41 applicants for the position.

Mr. Francis Hodgkinson, consulting mechanical engineer, Westinghouse Electric & Manufacturing Co., is attending the World Power Conference and the meeting of the International Electrotechnical Commission. Mr. Hodgkinson joined the Westinghouse Company in 1896, having previously spent several years with Messrs. C. A. Parsons & Co., Ltd.

M. Trachtenburg, a director of the Société des Accumulateurs Dinin, Paris, has been appointed a Chevalier of the Legion of Honour.

Mr. Michael Forrest, a member of the Waterford Corporation, has been appointed area manager in Co. Tipperary by the Irish Free State Electricity Supply Board. His headquarters will be in Clonmel.

Mr. H. Ainscough, on June 2nd, was presented by the Knaresborough Urban Council with a framed illuminated address in recognition of his services as electrical engineer to the Council from the inception of the local electricity scheme in 1924 to its transfer to the Harrogate Corporation in February last.

Mr. Henry Savage's retirement from the position of manager of the North Woolwich works of Messrs. W. T. Henley's Telegraph Works Co., Ltd., was reported in our last issue. Mr. Savage, whose portrait accompanies these notes, started as a junior with Henley's forty years ago and was appointed works manager in 1919. At the meeting at which presentations were made to Mr. and Mrs. Savage a letter was read from Sir George Sutton (chairman of the company) expressing his regret at Mr. Savage's decision to retire. The presentations were made by Mr. Percy Rosling, general manager, who paid a high tribute to Mr. Savage's work for the company, and said that he had achieved a good deal to rise from a junior to the managership of the Woolwich works. In acknowledging the gifts Mr. Savage said that there were various reasons for his retirement, but they were purely personal and voluntary. The management did not wish him to leave and he had no difference with the company, the management, the staff, or the workpeople. He drew a number of interesting comparisons between the conditions existing 40 years ago and those obtaining at the present time, particularly as regarded the equipment of the works, the hours of work and the welfare of the employés.

Mr. Henry Savage.

Who has retired after 40 years' service with Henley's.

Mr. and Mrs. Savage are leaving shortly for a long sea voyage and hope to return home in January next year.

Mr. W. J. H. Walter, late manager of the Bristol branch of the Edison Swan Electric Co., Ltd., was presented on May 31st with a smoker's cabinet as a mark of esteem by the Bristol staff, on the occasion of his relinquishing control of the branch to join the head office lamp sales staff.

Sir William Coxen has consented to act as Festival President in connection with the 1930-31 appeal of the Commercial Travellers' Benevolent Institution.

Mr. James Orr, who has been manager of Messrs. James Kilpatrick & Son, Ltd., for the past four years, has been appointed managing director of the company.

Mr. D. Youdan is leaving the Yorkshire Electric Power Co. to take up a position with the Northampton Electric Light and Power Co., Ltd., as engineer for the Daventry district.

Mr. C. E. Lee-Jones is recommended for the position of assistant mains superintendent at Derby in the place of Mr. E. P. Eaton, resigned.

Mr. Charles Sykes, Ph.D., M.Sc., of the Research Department of the Metropolitan-Vickers Electrical Co., Ltd., was married to Miss N. Staton, of Clowne, Derbyshire, on June 2nd.

Mr. C. M. Shaw, city electrical engineer, Worcester, will be advanced to the I.M.E.A. scale (£1,080 at present) if a recommendation by the Electricity Committee is adopted by the City Council.

Mr. C. Cameron, A.M.I.E.E., of the sales staff of Messrs. Ferguson, Pailin, Ltd., has resigned, to take up an appointment with the English Electric Co., Ltd.

Mr. C. O. Stuart (formerly of Messrs. Young, Osmond and Young, Ltd.) has been appointed manager of the Electric Heating Department, of the Wardle Engineering Co., Ltd.

Obituary.

Mr. P. J. Pringle.—Several weeks ago we received word from Ballarat, Australia, to the effect that an old friend of the ELECTRICAL REVIEW, Mr. Percival John Pringle, chief engineer and general manager of the Electric Supply Company of Victoria, Ltd., had left on a holiday visit to this country. He was travelling, accompanied by Mrs. Pringle, *via* Spain and France, and we had been daily expecting him to look in at the REVIEW offices, until Thursday last week, when we were informed by the secretary of the company at Liverpool that Mr. Pringle was taken ill towards the end of May on his arrival at Zurich, Switzerland, and that he passed away there on June 10th. The deceased gentleman was born in 1870 and was in his 60th year. He received his electrical training at the old School of Electrical Engineering in Hanover Square, and after serving a pupilage at some locomotive works at Glasgow, he was associated for a short time with Professor George Forbes in electrical research work. A varied and valuable practical experience in electrical manufacturing and engineering work with Messrs. Drake and Gorham and the Brush Electrical Engineering Co., led him to important posts in connection with electricity supply station erection and equipment. In the power station branch of his career in this country he was resident engineer during the erection of the Wandsworth station of the County Co., and at the Watford, Sheffield, Huddersfield and Leicester undertakings. Later he was for from three to four years with Messrs. Kincaid Waller, Manville & Dawson, and had to do with the establishment of the Midland Electric Power Corporation's undertaking. Burton-upon-Trent was his last appointment (he was borough electrical engineer and tramway manager there) in this country before he left for Australia to take charge of the systems of the Electric Supply Co. of Victoria, Ltd., at Ballarat and Bendigo. During his lengthy period of eminent service there he figured prominently in public affairs. His knowledge of industrial and labour subjects, added to his long and varied experience of the control of important concerns employing much labour, qualified him to fill with authority and respect the office of arbitrator in connection with tramway labour disputes, and his contributions to the Press in Australia on such questions were of great value, as were his technical contributions to the Press at home, including the ELECTRICAL REVIEW. Mr. Pringle was a member of the Council of the Light Railways & Tramways Association, a member of the Institution of Electrical Engineers, and a member of the Institution of Mechanical Engineers. He was the inventor of many devices and appliances useful in electric tramway engineering and among other things patented the Pringle and Kent surface contact system.

On behalf of his many friends, including ourselves, we desire to tender to Mrs. Pringle words and feelings of deepest sympathy in her bereavement suffered under such distressing circumstances.

Mr. Jack Cave.—We regret to announce the death, which occurred on the 14th inst., of Mr. Jack Cave, one of the earliest of the Marconi Company's pioneers. Mr. Cave was in his 58th year and had been ill for several weeks. His special knowledge of the technique of glass blowing and his skill as a master instrument maker led to his appointment in 1897 to the personal research staff of the Marchese Marconi, whom he assisted in the construction of much of the early apparatus. He was thus the first mechanic to be associated with the commercial development of wireless telegraphy and under him in those early years the art of coherer manufacture and testing reached a high degree of precision and performance. He began his work at Bournemouth and it was continued at Poole, and in 1899 commercial manufacture was begun at Chelmsford. With the advent of the magnetic detector superseding the coherer Mr. Cave's wide practical knowledge led to his appointment in 1907 as foreman of the machine shop and he retained this position in the new works which were opened in 1912. In 1922 he was appointed chief rate fixer which position he held at the time of his death. He was greatly interested in sport, especially running and boxing, and was one of the founders, and a vice-president, of the Marconi Athletic and Social Club.

Mr. E. A. Sperry.—We regret to learn that Mr. Elmer A. Sperry passed away on Monday last in the United States. Mr. Sperry secured world-wide fame by his work on gyroscopes, notably by his invention of the gyro-compass. He was born in 1860 and at the age of 20 founded the Sperry Electric Co. in Chicago, which was mainly concerned with the production of arc lamps. Later Mr. Sperry invented and manufactured coal-cutters and other electrically-operated mining machinery, and then he formed one of the first electric tramway companies in the United States, that in Cleveland, Ohio. In many other directions he invented and improved, one notable achievement being a high-intensity search-light which was largely adopted for naval and military purposes. He produced his first gyroscopic compass about 20 years ago. It was taken up by the United States Navy and Mr. Sperry became an adviser to the Navy in this and allied matters. The inventor of the gyro-compass received recognition from many quarters of the world and was awarded the John Fritz gold medal. Mr. Sperry was a founder member of the American Institute of Electrical Engineers and of the American Electrochemical Society.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Onward Electrical Appliances, Ltd.—Private company. Registered June 6th. Capital £1,000 in 5s. shares. Objects: To carry on the business of dealers in apparatus, implements and accessories used in connection with electricity, electrical fittings, lamps and plant, &c. The subscribers are: Dorothy E. Crawford, 89, Gray's Inn Road, W.C.1, merchant; R. L. H. Cowan, 36, Great James Street, W.C.1, merchant. Secretary: Dorothy E. Crawford.

Umello, Ltd.—Private company. Registered June 11th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, installers and repairers of and dealers in wireless apparatus and accessories, &c. The subscribers (each with one share) are: G. F. Wrigley, 12, Norfolk Street, Strand, W.C.2., company secretary; G. W. Croot, The Chase, Marshalls Park, Romford, Essex (director, British Curtis Radio, Ltd.); the first directors are not named. Solicitors: Coburn and Co., 6, Drapers Gardens, E.C.

Bolton Gate Co., Ltd.—Private company. Registered June 10th. Capital, £100 in £1 shares. Objects: To carry on the business of mechanical and electrical engineers, iron and brass founders, &c. The directors are: J. Nightingale, 36, Ribblesdale Road, Bolton, printer; W. Nightingale, 36, Ribblesdale Road, Bolton, electrical engineer. Registered office: 10-12, Bowkers Row, Bolton.

Bolton Safety Hoist & Engineering Co., Ltd.—Private company. Registered June 10th. Capital, £100 in £1 shares. Objects: To carry on the business of mechanical and electrical engineers, iron and brass founders, &c. The directors and other particulars are similar to those of Bolton Gate Company, Ltd.

H. A. McQueen & Co., Ltd.—Private company. Registered June 7th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers of electrical switchboards and gear, electrical cinematograph, radio and aircraft appliances, &c. The directors are: H. A. McQueen, Thornhill, Uplawmoor, Glasgow, engineer; W. McNab, Woodneuk, Barrhead, Renfrewshire, engineer; J. W. Mackinnon, 6, Lynedoch Street, Glasgow, C.A. Registered office: 152, St. Vincent Street, Glasgow, C.2.

Ponsford & Co., Ltd.—Private company. Registered June 10th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical, motor and radio engineers, &c. The directors are: S. J. Ponsford, 6, Godfrey Street, Barnhill, Dundee, electrical engineer; F. Y. Henderson, 21, Arkley Street, Dundee, sales manager. Registered office: 73, Wellgate, Dundee.

Vaco, Ltd.—Private company. Registered June 13th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and wholesale and retail distributors of household and other appliances of a mechanical or electrical nature; advertising contractors and agents, &c. The directors are: F. Taylor, The Red House, Cheam, Surrey (director Radio Vacuum Co., Ltd., and other companies); W. F. Sparbam, Inverness Court Hotel, Inverness Terrace, W. (director United Overseas Trust, Ltd., and other companies). Registered office: 419, Oxford Street, W.1.

Nelson Electric Lamp Co., Ltd.—Private company. Registered June 13th. Capital, £750 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric, gas and oil lamps, quartz lamps, reflectors, globes, bells, fires, stoves, &c. The subscribers (each with one share) are: G. D. Pegrum, 101, Salisbury House, E.C.2, and F. A. Jones, 76, Boundaries Road, Balham, S.W., solicitor's clerks. Solicitors: Mawby & Barrie, 101, Salisbury House, E.C.2.

Leda Electric, Ltd.—Private company. Registered June 13th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, engineers, engineers' agents, coppersmiths, &c. The directors are: J. Morley, 37, Bloomfield Road, Heaton Moor, Stockport; F. O. Manning, 14, Pine Grove, Prestwich, Lancs. Registered office: Nelson Street, Miles Platting, Manchester.

"M.P.A." Wireless (1930), Ltd.—Private company. Registered June 13th. Capital, £10,000 in 1s. shares. Objects: To acquire the assets, patents, goodwill and business of "M.P.A." Wireless, Ltd., or any parts thereof from J. J. Ure, the receiver of that company. The directors are: A. E. Hodgson, 33, Adelaide Crescent, Hove (director, British Radio Corporation, Ltd.); A. St. G. Caulfield, Travellers' Club, Pall Mall, S.W. (director, British Radio Corporation, Ltd.); E. H. Dock, 30, Finsen Road, S.E.5; Doris de Sart, Women's United Services Club, 23, Courtfield Gardens, S.W.5. Secretary: J. S. Snare. Registered office: 62, Conduit Street, Regent Street, W.1.

Steam Users' Supply Co., Ltd.—Private company. Registered June 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, mechanical or general engineers, boiler and economiser makers, ironfounders, brassfounders, manufacturers of and dealers in steam, hot water and electrical plant, &c. The provisional directors are: G. F. Coombes, 480, Huddersfield Road, Wyke, Bradford, engineer; C. Bennett, 16, Barraclough Square, Wyke, Bradford, engineer. Secretary: G. F. Coombes.

Official Returns of Electrical Companies.

Anemostat, Ltd.—A. A. Lowe, C.A., of 12, Coleman Street, E.C., was appointed receiver and manager on May 30th, 1930, under powers contained in first and second debentures dated August 30th and December 18th, 1929.

Piccadilly Signs, Ltd.—J. H. Macaulay, of 82, Cranley Gardens, Muswell Hill, N.10, was appointed receiver and manager on June 2nd, 1930, under powers contained in first debenture dated May 31st, 1928.

Fairylites, Ltd.—Satisfaction to the extent of £200 on May 24th, 1930, of mortgage dated October 2nd, 1929, and registered October 3rd, 1929. (According to the register of mortgages, the mortgage registered October 3rd, 1929, originally secured £5,600.)

Victoria Garage & Electrical Co., Ltd.—Debenture dated May 30th, 1930, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Truphonic Radio, Ltd.—E. D. Basden, F.C.A., of 73, Basinghall Street, E.C., was appointed receiver on May 31st, 1930, under powers contained in debenture dated October 30th, 1929.

Haddon & Pearce, Ltd.—Capital, £5,000 in £1 shares. Return dated October 16th, 1929 (filed March 18th, 1930). 2,502 shares taken up. £2,002 paid. £500 considered as paid. Mortgages and charges, £1,800.

C.A.C. Valve Distributing Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1929. All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, nil.

Modern Radio, Ltd.—Capital, £200 in £1 shares. Return dated February 7th, 1930. All shares taken up. £200 paid. Mortgages and charges, nil.

Baynes Electrical Co., Ltd.—Capital £2,000 in £1 shares. Return dated October 21st, 1929. 214 shares taken up. £214 paid. Mortgages and charges, nil.

John Collier & Co. (Electrical Engineers), Ltd.—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated December 25th, 1929. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

Midland Electric Manufacturing Co., Ltd.—Capital, £187,500 in 75,000 preference and 112,500 ordinary shares of £1. Return dated March 11th, 1930. All shares taken up. £85,000 paid on 25,000 preference and 60,000 ordinary shares. £102,500 considered as paid on 50,000 preference and 52,500 ordinary shares. Mortgages and charges, nil.

Burgess Hill & District Electric Supply Co., Ltd.—Satisfaction to the extent of £1,200 on April 28th, 1930, of debenture dated June 17th, 1907, and registered June 22nd, 1907.

Power & Lighting Cables, Ltd.—Capital, £10,000 in £1 shares. Return dated March 18th, 1930. 1,100 shares taken up. £1,100 paid. Mortgages and charges, nil.

Poynter, Griffiths & Co., Ltd.—Capital, £20,000 in £1 shares. Return dated July 23rd, 1929 (filed March 15th, 1930). 14,671 shares taken up. £11,671 paid. £3,000 considered as paid. Mortgages and charges, £1,071.

Bordesley Electrical Accessories Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 24th, 1930. 4,812 shares taken up. £2,500 paid. £2,312 considered as paid. Mortgages and charges, £1,434 16s. 2d. (bank overdraft.)

Cardiff Electrical Repairs, Ltd.—Capital, £1,500 in 500 preference and 1,000 ordinary shares of £1 each. Return dated November 5th, 1929. 260 preference and 817 ordinary shares taken up. £577 paid on 260 preference and 317 ordinary shares. £500 considered as paid on 500 ordinary shares. Mortgages and charges, nil.

W. D. Foster & Co., Ltd.—Satisfaction in full on May 20th, 1930, of debentures dated March 18th, 1930, and registered March 28th, 1930.

J. Tee & Co., Ltd.—Capital, £500 in 10s. shares. Return dated December 30th, 1929. 603 shares taken up. £1 10s. paid. £300 considered as paid. Mortgages and charges, £1,000.

Magneto Concessions Company (England), Ltd.—Capital, £100 in £1 shares. Return dated November 29th, 1929 (filed January 23rd, 1930). All shares taken up. £100 paid. Mortgages and charges, nil.

Emery & Co., Ltd.—Particulars filed of £1,000 debentures authorised May 28th, 1930, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £600.

Mica Manufacturing Co., Ltd.—Particulars filed of £1,500 debentures authorised by resolutions of March 12th and 27th, and April 22nd, 1930, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

Furneaux & Thomas, Ltd.—Satisfaction to the extent of £400 on March 17th, 1930, of debenture dated July 16th, 1929, and registered July 23rd, 1929, securing £800.

City Notes.

General Electric Co., Ltd.

The accounts for the year ended March 31st last show a profit of £1,179,007, as compared with £1,084,078 in the preceding year. To this a balance of £362,072 is added, making £1,541,079. After meeting debenture interest, depreciation, preference dividends, &c., and transferring £130,000 (the same) to reserve, a balance of £694,676 remains. The ordinary dividend is maintained at 10 per cent., but in addition a bonus of 4 per cent. is to be paid; the balance carried forward is £379,165. The report states that the company had a record year. Though the later months were affected by the general depression in business, which still persists, the results justify the directors in recommending a special bonus, in addition to the normal dividend of 10 per cent. The company's works were fully employed during the period. Output was maintained at a high level, and the volume of orders received, in the aggregate, was satisfactory, though present conditions have restricted the demand for industrial apparatus. The company's business, both in heavy engineering and in general electrical commodities, has continued to expand. The volume of overseas trade showed a considerable increase. The branches in India and Argentina again had a successful year, and definite improvement was shown in Australia and South Africa. The low price of primary products is, however, restricting purchasing power in practically all overseas markets. The growth of business has again necessitated works extensions. The h.p. switchgear and transformer works and the cable works have been completed, and additional factories for the manufacture of lamps and valves are in course of erection. The number of the company's employés at March 31st was 24,873, an increase of 2,600. Mention is made of the appointment of Messrs. H. W. Roberts and F. Winstanley to the board, and the appointment of Mr. M. J. Railing as joint managing director. Meeting: June 25th.

Electric Supply Corporation, Ltd.

The accounts of this company were abstracted in our last issue, p. 1121, and the annual meeting was held on June 12th. Mr. J. G. B. Stone (chairman), who presided, said that the number of the undertakings in their own hands was reduced by the exclusion of Jedburgh, Dollar and Exmouth. The list of company undertakings was the same as the previous year with the exception of Wellington, with which they had parted. The lamp connections of their own undertakings showed an increase of 28,504, which was a normal figure. Referring to their subsidiaries, he said that the Central Sussex Electricity, Ltd., now owned the Haywards Heath Order, the Haywards Heath Extension Order, and the Hassocks and Hurstpierpoint Order. Its area was contiguous with that of the Uckfield Company and would join that of the Steyning Company when the latter company's area had been extended. Their interests in that area, therefore, together with those of the Newhaven and Seaford, Petersfield and Alton Companies, formed an important feature in the counties of Sussex and Hampshire. The report and accounts were adopted.

Mexican Light & Power Co., Ltd.

The revenue for the year ended December 31st last was $4,849,770 (against $4,729,570 in 1928). Administration and general expenses totalled $142,139, interest on bonds $2,530,684, and $999,086 is transferred to reserve for sinking funds, leaving a balance of $1,177,860. This has been applied in the payment of two half-yearly dividends in respect of 1929 on the 7 per cent. preference shares, and on the 4 per cent. second preference shares, leaving $529,860, which, with $1,456,453 brought in, is carried forward. The directors report that satisfactory arrangements have been made with the approval of the Bondholders' Committee for financing requirements for capital expenditure for some time to come. This arrangement provides for the sale of a maximum amount of $5,000,000 at par of 7½ per cent. general unsecured bonds, of which $2,100,000 had been paid for and delivered at the date of the report.

Mexico Tramways Co.

The gross earnings for 1929 were $10,724,938 (Mexican currency), as against $11,684,875 in 1928, and there was a net operating profit of $225,093 ($930,977). The president, in his report, states that the falling off in the gross and net earnings was due to the constantly growing competition from the omnibuses and jitneys which have increased, both in number and efficiency. The amount remaining after payment of fixed charges was set aside towards meeting necessary capital expenditure for improving and developing the company's system.

British Electric Traction Co., Ltd.

The annual meeting of this company was held on June 16th, Mr. J. S. Austen (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, May 16th, p. 925), the chairman said that the profits during the past year had increased by £56,000. During the year the Pelotas undertaking in Brazil was sold, and the net effect of the transaction was that about £300,000 which had hitherto been unproductive would now come gradually into bearing. Sales had also taken place of various omnibus interests by their allied company, the Tilling and British Automobile Traction Co., and themselves. Since the end of the year under review, their subsidiary, the Birmingham and District Investment Trust, had declared a bonus of 100 per cent. in 6 per cent. preference shares, which would bring them in £50,000 a year. The report and accounts were adopted.

Calcutta Tramways Co., Ltd.

Presiding at the annual meeting on June 11th, Mr. J. G. B. Stone (chairman) said that the tramway receipts showed a reduction of £5,030, due to general trade depression, intensified omnibus competition, continual labour troubles, &c. Regarding the omnibus position, he said that the intense competition had rendered most concerns unremunerative. While they were convinced that the tramway system in Calcutta was best suited to the needs of the bulk of the people of that city, they also realised that the motor omnibus was necessary to provide feeder and complementary services, and it was for these purposes that their omnibuses were mainly used in Calcutta. The report and accounts were adopted.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.

In presenting their statement for the first half of the current year, the directors state that the results have not come up to their expectations. Trade conditions in the industry, in common with many others, have been very difficult and have adversely affected certain sections of the company's business. Other sections, however, are maintaining both output and profits and the directors are taking energetic steps to develop these departments and, if necessary, to restrict or even abandon others which hamper progress. From past experience they look for the usual improvement in the second half of the company's year and they have decided that the preference dividend due on July 1st shall be paid on that date.

Hick, Hargreaves & Co., Ltd.

The accounts for the year ended March 31st show that after providing for depreciation, debenture interest, &c., there was a profit of £15,110, to which is added £5,370 brought forward, making £20,480. The directors propose to pay a dividend at the rate of 3 per cent., less tax, and to transfer £10,000 to general reserve, the balance of £3,280 being carried forward. The report states that the turnover again increased. The value of contracts secured during the year was also higher than during the previous year.

American and Foreign Power Co.

The report for 1929 shows net earnings of $24,756,305, an increase of over 89 per cent. as compared with 1928. The net amount available for common stock was equivalent to $4 per share on the 1,623,357 common shares outstanding at the end of 1929, as compared with $1.22 per share on 1,248,930 shares outstanding at December 31st, 1928. The most important of the numerous acquisitions made during the past year was the electric light and power property of the International Settlement at Shanghai for which $50,625,000 was bid. The company also extended its operations to India, where a half-interest was acquired in the Tata Hydro-Electric Agencies, Ltd.

Mirrlees, Bickerton & Day, Ltd.

The net profit for the year ended March 31st last was £32,134, to which is added £8,504 brought forward, making £40,638. A dividend of 7 per cent., less tax, is proposed on the ordinary shares (same for 1928-29), and £12,283 is carried forward. The report refers with regret to the death of Mr. H. N. Bickerton. Mr. H. C. Bickerton has been appointed a director in his place.

Electramonic Co., Ltd.

At an extraordinary general meeting on June 11th, presided over by Mr. A. J. Nathan, the scheme for the reconstruction of the company was approved. The arrangements involve the winding up of the company, with Mr. G. E. Seaman as liquidator, and the formation of a new company to be called the Electramonic Co. (1930), Ltd.

James Keith & Blackman Co., Ltd.

The report for the year ended March 31st last shows a profit of £48,601 (against £43,087 in 1928-29). It is proposed to place £12,000 to reserve and to pay a dividend of 17½ per cent., less tax (15 per cent. in the previous year), leaving £16,244 to be carried forward.

English Electric Co., Ltd.

We regret that in the note bearing this heading in our last issue the name of Sir Edward Hilton Young, M.P., who has been appointed to the board of the company, was incorrectly given as "Sir Edward Hilton."

Eastern Telegraph Co., Ltd.

The directors announce a dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the quarter ending June 30th.

Associated Telephone & Telegraph Co.

The following quarterly dividends have been declared:—First preferred stock, $1.75 per share; classes "A" and "D" stock, $1 per share.

Electric & General Investment Co., Ltd.

A final ordinary dividend of 5 per cent. has been declared, again making 10 per cent. for the year. The dividend on the deferred shares is raised from 100 to 200 per cent.

Associated Electrical Industries, Ltd.

The half-yearly dividend on the 8 per cent. cumulative preference shares is to be paid on July 1st.

International Telephone & Telegraph Corporation.

A regular quarterly dividend of 50 cents per share has been declared, payable on July 15th, 1930.

Sternol, Ltd.

An interim dividend of 4 per cent. actual has been declared on the cumulative participating preferred ordinary 10s. shares.

German Companies.

The *Accumulator Company*, of Berlin-Hagen, records net profits and balance forward amounting to 3,920,000 marks for 1929, as compared with 2,190,000 marks in the preceding year. It is again proposed to pay a dividend of 8 per cent., with the addition of a bonus of 10 per cent.

The *Robert Bosch Company*, Stuttgart, reports that the course of business in 1929 was irregular, although the turnover increased by 3 per cent. The net profits amounted to 2,230,000 marks, against 1,920,000 marks in 1928, but as it is desired to cope with developments out of existing funds, it is again not intended to pay any dividend.

The *Voigt and Haeffner Co.*, Frankfort-on-Main, states that 1929 was not a satisfactory year as the decline in orders in the summer continued until the end of the year, and competition was very keen, with falling prices. The net profits were 618,000 marks, against 810,000 marks in 1928, and the dividend is reduced from 9 per cent. to 6 per cent.

French Company.

The *Compagnie Générale d'Applications Electriques* reports net profits of 907,000 fr. for 1929; the dividend is at the rate of 11 per cent.

Stocks and Shares.

TUESDAY EVENING.

NEW YORK depression and flatness continue to exercise a disturbing effect upon conditions in the money markets of London and the Continent. In spite of the fact that capital finds difficulty in obtaining employment at remunerative rates, the general volume of business in stocks and shares is disappointingly small. It is said that money in Paris has fallen to a rate at which it is scarcely worth lending, and that day-to-day loans have been negotiated on a basis of ¾ per cent. per annum. The American speculator is evidently far from happy over his holdings of utility shares, the prices of which are on the down grade. There is, on the other hand, a feeling that so far as the prices of metals, commodities and raw products are concerned, these may be thought to have approached somewhere near the lowest prices which they are likely to touch. A few indications have been manifest during the past week which suggest that business in certain directions is by no means so bad as superficial observation is disposed to believe. The most hopeful sign is the declaration of a dividend of 10 per cent., the usual rate, by the General Electric Co., Ltd., accompanied, however, this year by an unexpected bonus of 4 per cent., raising the total distribution for the year to 14 per cent. The effect was to advance the price of the shares from 47s. to 53s. The inevitable profit-taking ensued, and General Electrics came back to 48s. 9d., leaving them 1/16 higher on the week. The report is extremely satisfactory. Associated Electrical Industries shares failed to participate in the strength shown by G.E.C.'s, the price having receded 1s. 9d. to 23s. 9d. The company is going to pay its preference dividend half-yearly in future, instead of annually as heretofore. In accordance with this intention, the first of the six-monthly dividends at the rate of 8 per cent. per annum for the half-year ending with this month will be paid on July 1st.

Dollar Stocks.

Following upon the sharp shake-out which occurred in Americans and Latin-Canadians in the previous week, further declines have taken place, Shawinigans, for instance, going back to 69, a fall of 7 points. Power Corporation of Canada, which fell heavily last week, are 6 dollars down at 75½. Pennsylvania Water and Power followed up their drop of 9 with another fall of 3, which left the price at 74½. Brazilian Tractions at 40 have shed 6. The Mexican group is weak; Mexican Light and Power common fell 8 points to 77½, and Mexico Tramways at 22½ are 2 down. The Mexican Light and Power Company reports a balance for the year 1929 of $1,177,800, which shows an improvement of about $14,000 on the year. Dividends have been paid on the company's 7 per cent. preference shares and the 4 per cent. second preference. The company proposes to increase the authorised share capital by the creation of a further 60,000 ordinary shares of no par value. "With the exception of some debts," says the report, "due from the Federal Government, no further progress has been made in the collection of large indebtedness due from various Government departments, though there was some improvement in settlement of current accounts." The present price of 77½, while still well above the lowest touched during the present six months, goes against 98 as the highest; while last year the price touched 129 at one time. Hydro-Electrics have dropped to 40½; International Holdings to 5½.

Bermuda Traction.

There is to be a meeting in the City on Friday in this week of the holders of the 7 per cent. participating debenture stock of the Bermuda Traction Company, at which meeting a resolution will be proposed postponing, to January 1st next, the payment of interest due on January 1st and July 1st in this year. The postponement has also been proposed of the first payment in respect of the sinking fund to the end of this year, while the rights of holders of the participating debenture stock are to be modified, according to the resolution, if passed, so as to permit the company to create and issue 7 per cent. prior lien debentures not exceeding £100,000. It has been known, of course, for some time past that further money would be required. The price of the 7 per cent. debenture stock is nominally about 25, and the ordinary shares stand at a florin. The Board and the Debenture Stockholders Committee advise acceptance of the proposals now made. The company has been exceedingly unlucky since the issue of the debenture stock was first placed with investors. Although holders of the debenture stock will feel a natural reluctance to having a prior charge placed in front of their security, the latter method would appear to be the only way whereby new capital can be raised, and the company afforded the opportunity for fulfilling the hopes which were entertained when the issue of debenture stock was originally made.

Home Railways.

Underground Electric income bonds at 109 are a point easier, and Metropolitan consolidated stock at 64½ is 1½ lower. The Underground £1 shares keep their price of 23s., and the optimists are talking of the possibility of the dividend being raised, if not this year, then at some tolerably early date, from the present-paid 8 per cent. to at least 9 per cent.

The company has on hand a very comprehensive programme of extension and improvements, the cost of which is expected to run into something like 13 million pounds. Part of the scheme is concerned with the extension of the present Tube, which ends at Finsbury Park, to Cockfosters, in the North; and from Hammersmith to Northfields in the West. In addition to this expansion, work is to be undertaken for converting some of the London stations into sub-surface stations. The contribution which the putting in hand of this programme will make to the increasing pressure of the unemployment problem is of high importance, and it will also give a stimulus to a number of trades affected by the carrying out of a work of such consequence.

Electricity Supply Shares.

Charing Cross ordinary at 28s. are a shilling higher on the week, and North Metropolitan ordinary strengthened to 47s. 3d. Other changes are small, and reflect a little selling on behalf of people who find themselves obliged to raise money through the sale of good stocks in order to meet financial commitments incurred in other directions. Metropolitan ordinary have gone back to 39s. 9d. as an indirect reflection of the weakness which has prevailed in American stocks and shares. County of London at 45s. 9d. are 1s. 9d. down. Yorkshire Electrics have lost 2s. 6d. at 31s. 3d. Egham and Staines at 30s. 9d. are a shilling lower. Isle of Thanet remain at 27s. 9d., and the preference are 23s. 3d. Newcastle and District at 25s. 6d. show no change. British Light and Power remain dull at 14s. Scottish Power new shares, which were 1s. premium a fortnight ago, have reacted to their par price, owing to the competition that there is nowadays on the part of new issues to catch the attention of the public. Northamptons are dull at 45s., and Midland Counties at 27s. Atlas ordinary have receded to 26s., the preference to 24s. 3d.

Cables and Wireless.

There is nothing encouraging to say to holders of Cables and Wireless stocks. The price of the 7½ per cent. "A" ordinary has fallen 3 to 37½. The 5½ per cent. preference and the "B" ordinary stocks are 1 and 2 points down respectively. Sir Basil Blackett's recent homily, instead of proving of benefit to the market, had no effect. It would appear as though bear selling has been supplemented by forced realisations on the top of this, effected by holders not only tired, but afraid of the stocks. There is nothing in the position to induce support, though it is just at a time like this, when a market seems to be entirely unbefriended, that recovery may take place. The weakness has extended to the shares of the American undertakings. American Telegraph and Telephone at 216 is 14 points down, following upon its fall of 8 a week ago, and International Telephone and Telegraphs at 44 are 13½ lower, this also coming after an 8 point drop in the previous week. The International Company has declared its usual quarterly dividend of 50 cents. Marconi Marines are heavy at 33s. 9d. Canadian Marconis gave way to 25s.

Miscellaneous Matters.

India-Rubber, Gutta-Percha, and Telegraph, after improving to 10s., went back to 8s. 9d., leaving a fall on the week, on the announcement that the results for the first half of the current year have not come up to the directors' expectation. Trade conditions in the industry, they state, have been very difficult, but the usual improvement in the second half of the company's year is looked for. A further fall of £1 a share has taken Telegraph Constructions to 18½. British Aluminium ordinary further weakened to 38s. 9d. Babcocks are unchanged at 56s. 3d. The rest of the shares in this section are steady. Callender's report is regarded as being very encouraging. Details were given in last week's Electrical Review, page 1120. Philips Lamp shares, notwithstanding their shake-out, receded to 57s. 6d. Telephone Manufacturing (1929) are quoted at 9d. per share, and Telephone Rentals at 3s. 3d. English Electric ordinary remain at 3s. 9d., the preference at 7s. 6d., there having been no change on the company's announcement that it has entered into a comprehensive agreement with two United States Westinghouse companies, which will take a financial interest in the English Electric by acquiring ordinary shares to the extent of not more than 10 per cent. of the total.

Rubber shares are flat, on the weakness in the price of the product.

"Atkin's Manual."

The latest edition of "Atkin's Manual" has just been published, and is marked by the meticulous accuracy and the lucid demonstration of statistics to which previous volumes of the series have accustomed its readers. The book is a remarkable compilation of matter relating to practically everything in the electrical supply and traction industry, details being given of British, Colonial, and foreign companies, in a manner which renders reference easy and comprehensive. There is a short *résumé* of the purchase powers of the Acts governing lighting and tramway undertakings in Great Britain; the Electricity Supply Act of 1926 is set out, as regards its main provisions, in a simple form, showing in what manner the numerous public limited liability and parliamentary companies now generating and supplying electricity will be affected.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price June 17 1930.	Rise or fall	Yield p.c.
Bournemouth and Poole	£ 1	15	15	57/6	—	5 4 3
Brompton Ordinary	1	8½	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	28/-	+1/-	5 0 0
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8⅞	8⅞	26/6	—	5 5 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	38/3	—	4 3 9
County of London	1	7	10	45/9	−1/9	4 7 4
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Edmundson's 7% Pref.	1	7	7	24/6	—	5 14 3
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7	25/-	—	5 12 0
London Electric	1	8½	9	29/6	—	4 15 0
Metropolitan	1	9	10	39/9	−1/9	5 1 3
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	7	27/-	—	5 3 8
Mid. Elec. Power	1	15	8	32/-	—	5 0 0
Newcastle-on-Tyne Ordinary ...	1	6	6	22/6	—	5 6 8
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	—	5 5 9
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	28/-	−1/-	5 14 4
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	32/6	—	4 6 2
Westminster Ordinary	1	8½	8½	27/-	—	5 3 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	31/3	−1/9	5 2 3

Home Rails.

Central London Ord. Assented ...	Stock	4	4	77	—	5 4 0
Metropolitan	,,	3½	4	64½	−1½	6 4 0
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	7	8	23/-	—	6 19 2
do. do. Income ...	Bonds	6	6	109	−1	5 10 1

Telegraphs and Telephones

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	88½	−1	6 4 4
do. A 7½ Ord.	,,	—	—	37½	−3	... ...
do. B Ord.	,,	—	—	17½	−2	... ...
Globe Tel. and T. Ord.	10	10	10	19	—	*5 5 3
do. do. Pref.	10	6	6	11½	—	5 9 1
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	1 1/2	−⅛	8 17 10
Oriental Telephone Ord.	1	12	12	55/-	—	*4 7 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	£ 5½	5½	2 1/2	−1/8	9 15 6
do. do. 2nd Pref. ...	5 6	6	2 7/8	−1/8	11 4 2
do. do. 5% Deb. ...	Stock 5	5	68½	—	7 0 0
British Electric Traction Def. Ord.	,, 5	5	1725	—	... ...
do. do. Pref. Ord.	,, 8	8	126½	—	6 6
Brazil Traction	100 7	8	40	−6	5 0 0
Brit. Columbia Elec. Rly. Pce. ...	Stock 5	5	99½	—	5 7 0
London & Sub. Trac. 5% Pref. ...	1 Nil	Nil	9/6	−6d.	... ...
London United Tram Deb. ...	Stock 4	4	52½	—	7 12 4
Mexico Trams, 5% Bonds	— 5	5	67½	—	7 8 2
Mexican Light Common	100 Nil	Nil	77½	−8	... ...
do. 7% Pref.	100 7	7	76½	—	9 3 0
do. 1st Bonds	— 5	5	81	—	6 5 0
Victoria Falls Ord.	1 15	15	3	−1/8	5 0 0
Yorkshire (West Riding)	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1 6	6	23/9	−1/9	5 1 1
Babcock & Wilcox	1 13	15	56/3	—	*5 6 9
British Aluminium Ord.	1 10	10	38/9	−⅜	5 3 3
British Elec. Transformer Pref. ...	1 7	7	8/9	—	... ...
British Insulated Ord.	1 15	15	9⅜	—	... ...
Brush Ord.	Stock 10	10	120	—	4 0 0
Callenders	1 15	15	8⅝	—	8 6 8
do. 6½% Pref.	1 6½	6½	23/9	—	4 3 0
Crompton Parkinson Ord.	5/- —	30	25/-	—	5 9 5
do. 8% Pref.	1 8	8	25/-	+6d.	6 8 0
Edison-Swan 1st. Pref.	1 7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock 5	5	84½	—	5 18 4
Electric Construction	1 5½	5	13/3	—	7 11 0
Enfield Cable Ord.	1 20	20	4½	—	4 14 1
English Electric	1 Nil	Nil	2/9	—	... ...
do. do. Pref.	1 3	Nil	7/6	—	... ...
Gen. Elec. Pref.	1 6½	6½	23/6	—	5 10 7
do. Ord.	1 10	14	48/9	+1/8	5 14 2
Henley	1 25	30	6 7/8	+1/8	4 17 0
do. 4½% Pref.	5 4½	4½	4½	—	5 6 0
India-Rubber	1 Nil	Nil	8/9	−6d.	... ...
Johnson & Phillips	1 10	10	1½	—	5 6 8
Siemens Ord.	1 7½	7½	23/9	—	6 6 4
Telegraph Construction	12 10	10	18½	−1	*6 7 6

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during May.

AS was to be expected, the Board of Trade returns of our overseas electrical trade during May show advances upon the April figures on account of Easter falling in that month. In the case of exports the increase was general, the only exception being a decline of £25,934 in shipments of telegraph and telephone instruments and apparatus. The other two items of the telegraph and telephone class showed a combined increase of £87,740. The machinery section made the substantial advance of £99,833, to which each of the three items contributed. Exports of glow lamps were also well up. As compared with the May, 1929, figures, however, exports fell by £232,000, reducing the increase for the completed part of the year to £68,656. The greatest decline was shown against unenumerated goods and apparatus, but insulated wires and cables and telegraph and telephone apparatus also fell by over £79,000. Considerable decreases were registered against non-submarine telegraph and telephone cables, batteries and accumulators, and meters and instruments. There was an improvement of £13,791 in the machinery section, due entirely to greater exports of the unenumerated class. The only other increase of any size occurred in the case of submarine cables, but this item is always subject to wide variations.

The increase in imports as compared with April indicated a slackening tendency, for the total was well below the average for the first three months of this year. Nevertheless, the figure was higher than that for the corresponding month of 1929. An outstanding item is meters and instruments, which showed an advance of £88,014 over last year's figure. This is the only class (with the small exception of carbons) in which imports exceed exports. The imports of machinery continued to rise; the slackening tendency to which reference is made above was confined entirely to goods and apparatus.

A sudden jump in the re-export total was due to a substantial rise in the shipments of telegraph and telephone apparatus. This brought the total for the first five months of the year to £154,729 above that for the corresponding period of 1929, the increase being better than that in the case of exports—a most unusual position.

The inset table shows the distribution of our electrical machinery exports during last month, the figures being compared, both quantities and weights, with those for May, 1929. The fall in values during the past year may be inferred from the fact that while exports of this class rose in weight by 11.5 per cent., the value increased by only 2.5 per cent. The increase was well distributed, the outstanding rises occurring in the cases of New Zealand and South America. There was a serious decline in shipments to Australia. It is satisfactory to note that two of the greatest increases in exports of electrical machinery so far this year are credited to Europe and South America, which are considered to be the most difficult of markets.

Destination.	Quantities. May, 1929. Tons.	May, 1930. Tons.	Inc. or dec. Tons.	Values. May, 1929. £	May, 1930. £	Inc. or dec. £
Europe	488	498	+ 10	98,467	109,153	+10,686
Japan	34	100	+ 66	7,752	16,054	+ 8,302
South America ...	209	352	+143	40,219	62,384	+22,165
South Africa ...	253	371	+118	40,169	46,881	+ 6,712
British India ...	710	763	+ 53	112,432	121,717	+ 9,285
Australia	551	381	−170	92,552	52,642	−39,910
New Zealand ...	80	303	+223	13,855	38,608	+24,753
Canada	244	320	+ 76	37,184	38,346	+ 1,162
Other countries ...	766	629	−137	118,726	89,362	−29,364
Totals ...	3,335	3,717	+382	£561,356	£575,147	+£13,791

	Exports. Electrical exports for May, 1930.	Inc. or dec. as compared with April, 1930.	Inc. or dec. as compared with May, 1929.	Imports. Electrical imports for May, 1930.	Inc. or dec. as compared with April, 1930.	Inc. or dec. as compared with May, 1929.	Re-Exports. Electrical re-exports for May, 1930.	Inc. or dec. as compared with April, 1930.	Inc. or dec. as compared with May, 1929.
Electrical goods and apparatus (unenumerated)	£231,934	+ £6,102	− £92,220	£140,361	+ £15,858	+ £9,132	£7,196	−£4,748	−£4,583
Insulated wires and cables ...	261,086	+ 5,024	− 79,015	75,823	− 4,005	− 6,711	318	− 30	− 1,352
Glow lamps	64,231	+ 29,127	+ 3,028	30,577	+ 8,351	+ 7,577	433	− 603	− 207
Arc lamps and parts	2,432	+ 1,279	+ 1,720	1,457	− 338	+ 342	154	+ 65	+ 154
Batteries and accumulators ...	72,630	+ 1,238	− 13,234	51,226	+ 18,152	+ 207	224	− 184	− 1,240
Meters and instruments ...	31,332	+ 452	− 16,047	117,352	− 18,892	+ 88,614	2,763	+ 911	+ 1,954
Carbons	2,281	+ 1,147	+ 1,897	14,644	− 1,242	+ 4,764	60	− 82	− 320
Switchboards (not telegraph or telephone)	5,821	+ 1,549	+ 1,893	106	− 13	+ 106	—	—	− 43
Electrical Machinery—									
Electrical machinery (unenumerated)	346,224	+ 59,058	+ 20,875	187,089	+ 23,939	+ 2,961	14,369	+ 4,998	+ 441
Railway and tramway motors	20,530	+ 16,268	− 3,386	—	—	—	—	—	—
Other motors and generators...	208,393	+ 21,507	− 3,698	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	102,448	+ 31,359	− 35,924	5,573	+ 3,420	+ 2,085	—	—	—
Submarine telegraph and telephone cable...	76,945	+ 56,381	+ 61,584	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	192,033	− 25,934	− 79,397	80,082	+ 6,095	− 22,872	37,983	+ 34,302	+31,989
Totals	£1,618,320	+£207,557	− £231,924	£704,290	+ £51,325	+£85,605	£63,500	+£34,629	+£26,793
Increases for first five months of 1930.			Exports £68,656			Imports £1,017,733			Re-Exports £154,729

Electrical Imports of Java and Madura.

Figures for 1927 and 1928 Compared.

THE following statement is based on recently-issued official statistics, and shows the values of the imports of electrical and allied material into Java and Madura during 1928. The figures for 1929 have been added for purposes of comparison and notes of increases or decreases given. The guilder is worth about 1s. 8d.

	1927. Thous. Guilders.	1928. Thous. Guilders.	Inc. or dec.
Electric lamps, incandescent—			
Total	1,030	1,580	+550
From Holland	810	1,260	+450
,, Germany	130	220	+ 90
Insulators (private)	110	80	- 30
Do. (Government)	70	106	+ 36
Uninsulated and insulated electric wire—			
(*a*) of aluminium—			
Total (private) all from U.S.A.	160	70	- 90
(*b*) of iron—			
Total (private)	50	35	- 15
Total (Government)	90	95	+ 5
(*c*) of copper—			
Total (private)	1,390	1,490	+100
From Holland	440	620	+190
,, Germany	530	540	+ 10
,, Japan	180	230	+ 50
Total (Government)	450	620	+170
From Holland	360	180	-180
,, Germany	70	340	+270
Electric cables—			
Total (private)	1,020	1,115	+ 95
From Holland	280	550	+270
,, Great Britain	1	12	+ 11
,, Germany	570	480	- 90
,, Japan	40	14	- 26
Total (Government)	310	210	-100
From Holland	100	130	+ 30
Materials for overhead transmission lines—			
Total (private)	670	560	-110
From Germany	430	380	- 50
,, United States	8	7	- 1
,, Holland	205	160	- 45
Total (Government)	370	1,060	+690
From Holland	210	970	+760
,, Germany	160	60	-100
Materials for electrical installations in buildings—			
Total (private)	670	780	+110
From Germany	520	600	+ 80
Batteries—			
Total (private)	180	400	+220
From Germany	18	40	+ 22
,, United States	100	270	+170
,, Japan	20	28	+ 8
Total (Government)	60	105	+ 45
Accumulators—			
Total (private)	380	370	- 10
From Great Britain	60	70	+ 10
,, Germany	120	135	+ 15
,, United States	180	160	- 20
Total (Government), nearly all from Holland	630	270	-360
Wireless installations and apparatus—			
Total (private)	500	980	+480
From Holland	260	580	+320
,, Great Britain	70	60	- 10
,, Germany	130	250	+120
,, Total (Government)	550	320	-230
From Holland	410	260	-150
,, Germany	100	12	- 88
,, Great Britain	*	26	—
Telegraph and telephone apparatus, &c.—			
Total (Government)	190	310	+120
Total (private)	100	85	- 15
From Germany	44	28	- 16
,, Great Britain	25	28	+ 3
Electrical installations and apparatus, unspecified—			
Total (private)	1,060	970	- 90
From Germany	850	650	-200
,, Holland	150	260	+110
,, Switzerland	20	16	- 4
Total (Government)	190	76	-114
From Holland	*	46	—
,, Germany	130	23	-107
Electric fans and ventilators—			
Total (private)	104	160	+ 56
From Holland	10	30	+ 20
,, Germany	42	50	+ 8
,, United States	40	50	+ 10
Dynamos, motors, transformers and rotary convertors, not elsewhere specified—			
Total (private)	2,000	1,560	-440
From Holland	390	554	+164
,, Great Britain	30	85	+ 55
,, Germany	1,140	680	-460
,, United States	70	26	- 44
,, Switzerland	280	146	-134
Total (Government)	250	130	-120
From Holland	120	74	- 46
,, Germany	120	32	- 88
Automobile dynamos—			
Total (private)	26	49	+ 23
Parts of dynamos, electric motors, transformers and rotary convertors—			
Total (Government)	50	17	- 33
Total (private)	230	280	+ 50
From Germany	140	150	+ 10
,, Holland	60	90	+ 30
,, United States	6	12	+ 6
,, Great Britain	6	8	+ 2

* Not specified.

Electrical Manufacturing in Russia.

A Report on Two Leading Works.

INFORMATION regarding the position of the Russian electrical manufacturing industry was placed before a district political conference held in Leningrad early in June, the authors being works committees at the Leningrad Engineering Works (which bears the name of the Stahlin works) and at the Elektrosil works in that city. The object of the publication of the information, which appears in a Moscow official newspaper, is to endeavour to show that Russia is gradually becoming independent of imports of electrical machinery and equipment.

According to the report from the Stahlin works, during the 20 years preceding the revolution, this particular works turned out turbines of a total capacity of 150,000 kW. But in 1929 alone, its production is claimed to have amounted to 100,000 kW. In May, 1930, this works completed the first 24,000-kW turbine made in Russia. This machine is stated to have been constructed in two months and a half, whereas the time occupied by an English works, whose name is mentioned, in producing a machine of the same size is put at six months. Hitherto, the blades for turbine rotors have been imported from other countries, but in the case of the new machine they were made at the Stahlin works. Moreover, shafts have so far been obtained from a Czech works, but these are now also made at the works of the Krasny Putilovetz.

The output of the Stahlin works in the current year is to include turbines representing a total of 200,000 kW; in 1931-32 it is to be 560,000 kW, including two turbines of 50,000 kW each; and in 1932-33 the programme calls for the delivery of turbines of a total of 1,000,000 kW, together with a large number of steam boilers. It is said that the workmen have given an assurance that they will carry out the 1,000,000 kW programme in that year.

A new type of boiler is reported to have been devised at the Stahlin works, and two such boilers are to be completed in July this year. This type of boiler is to be substituted for an English make which has hitherto been imported or built up at Russian works from sections and materials sent from England. The new type of boiler is claimed to be more efficient and of simpler construction than imported boilers.

It is now suggested that orders should be placed with the Stahlin works for the delivery of the water turbines for the second section of the great Dnieper power station. In order to execute this order in the shortest possible time it will be necessary to re-equip the works with new machine tools and hasten the erection of the shop for this class of work.

In the case of the Elektrosil works, it is stated, that up to 1917 turbo-generators were imported from abroad, not a single works in Russia having taken the risk of constructing these machines. But the Elektrosil, beginning with machines of moderate size, is said to have now achieved great success. The works has provided 122 turbo-generators of a combined total of 441,500 kW in large power stations and in productive centres. In place of small generators, large machines of 6,000 kW, 10,000 kW, and over, have been installed, and orders are on hand for machines of from 44,000 kW to 88,000 kW, which a year ago it was intended to order from abroad. It is further stated that the Elektrosil works constructed some generators for the first hydro-electric station in Russia—the Volkhov works—and also for the Zemoavchalsky station. A completely new branch which has been taken up is the production of mercury-vapour arc rectifiers, and in this way the works is said to have obviated the necessity of importing rectifiers. Small motors which are largely used in industrial works, particularly in the textile industry, are being turned out in bulk, the quantity being 6,000 per month.

Tramways, Light Railways, and Transport Association.—I.

A Report of the Proceedings at the Twentieth Annual Conference at Hastings.

THE Tramways, Light Railways and Transport Association —to give the old Tramways and Light Railways Association its new and enlarged title—held its 20th annual Congress at Hastings from June 11th to 13th. The tendency for the attendances at the various annual Congresses, Conventions and Conferences in connection with the electrical industry to increase year by year, and for the importance of these functions to increase in even greater ratio than the attendance, was reflected in the present instance. For the past two years the attendance at the I.M.E.A. Convention has exceeded the thousand mark, last year the attendance at the annual conference of the Municipal Tramways and Transport Association approached the thousand, and now we find the attendance at the annual Congress of the other tramway and transport association beginning to leap up. The number attending at Hastings was between 250 and 300, well above the figures of previous years, and, in the same way, the discussions on the two papers presented were of a high order, as were also the papers.

The Conference opened with an informal reception on Wednesday evening, June 11th, at the Queen's Hotel—which was the headquarters of the Congress—by Mr. E. H. Edwardes (chairman of the Council of the Association and general manager of the South Lancashire Transport and Power Co.), but the Congress proper was opened in the Queen's Hotel on the following morning, Thursday, June 12th, when the Mayor of Hastings—Mr. Russell-Davies, K.C.—officially welcomed the Association in one of the several delightful speeches which he made from time to time during the Congress. Afterwards the annual general meeting of the Association was held.

On Thursday, June 12th, the Association was entertained at luncheon at the Queen's Hotel by the Hastings Corporation, and on the following day the Hastings Tramways Company entertained the Hastings Corporation and the Association at luncheon at the White Rock Pavilion. On the Friday evening the Association annual dinner was held at the Queen's Hotel. At all of these functions the speeches were few and of a felicitous nature, nothing in the way of a serious speech being attempted. On the proposal of Sir Arthur Stanley (president of the Association), who came to Hastings specially to be present at the dinner, all those present stood in silence for a few moments as a mark of respect for the late Sir Henry Segrave, news of whose death had just reached Hastings.

In connection with the Congress there was a demonstration of motor-'buses, which included two trolley 'buses. In all there were seventeen vehicles, a chassis, and a van load of accessories for motor 'buses and cars generally. The two trolley 'buses were made by the English Electric Co., Ltd., and Richard and Garrrett & Sons, Ltd., the latter being a vehicle for the Mexborough and Swinton tramways. The former is a double-deck, covered-top, trolley 'bus of the six-wheel variety capable of seating 60 passengers. The Mexborough vehicle is of the four-wheel type with a seating capacity of 32.

Substituting a Trolley-'bus System for a Tramway.

By W. VINCENT EDWARDS, A.M.I.E.E.

(Abstract.)

In view of the widespread interest which is being taken at the present time in the adoption and operation of trolley-'buses, possibly some account will be useful of the change-over of the Hastings Tramways, and the manner in which special conditions incidental to this town were met, or where departures from orthodox practice were executed.

Some of the principal considerations which led us to change over were the necessity to replace worn-out car equipments and to meet increasing competition of petrol-driven vehicles; the certainty that within a few years heavy permanent-way renewals and road costs would have to be incurred; and representations from the local authorities to provide some more modern system to replace the tramways. It was decided that it would be cheaper to install a more suitable system of transport to meet present-day conditions, whereby we could at the same time still be able to utilise the power-house and substations, and much of the transmission equipment, both overhead and underground, which had been provided for the tramway. It will be recognised that the above conditions apply to a greater or less extent to many of the smaller corporations in this country which own and operate electric supply stations. The large corporations are taking a greater interest in trolley-'buses, and they recognise the advantage of extending areas served by tramcars by utilising trolley-'buses. The lower operating and maintenance costs, the absence of all reciprocating parts, including "big-ends," gear-boxes, and other apparatus peculiar to motor-'buses, and especially the use of British coal instead of foreign fuel, are all points which will receive even greater attention as time goes on.

The tendency is very great to make a show and to put up negative wires alongside existing tramway ones, and only to move the latter a couple of feet, when five, six or eight feet is actually required, but it all means additional expense in the immediate future and mediocre service in the present. No negative wire at all should be erected until the positive wire is in correct position for trolley-'bus working. The great thing to realise is that switches, crossings and line work in general, which may be quite suitable for tramway speeds, are not sufficient for a trolley-'bus with its 20-ft. poles, its capacity for higher speed, and its ability to deviate from the normal line of running.

The scrapping of tramway rails raises the question of providing adequate copper for the return circuit. I am aware that many overhead-line engineers hold the opinion that the longest economic life is given by 3/0 trolley wire, but I believe this is based on experience generally with plain hard-drawn wire, in which, of course, only the skin is hard, and when this has worn through the central portion rapidly wears away. By using cadmium copper wire of 6/0 S.W.G. one would have an alloy which would be nearly equal in conductivity to pure copper, but of longer lasting qualities, and the rate of wear would be independent of any skin effect. It would also give a high contact area for the trolley wheels, and the pair of wires would be equal to 0.3 square inch.

A tramway rail set in position and then encased in concrete makes an excellent pole. Our old rails measure 6 in. by 6 in., and if a portion of the flanges is tapered off for 3 ft. or 4 ft. at the top, a pole is produced hardly bigger than a standard heavy-section one. Poles made in this way, inclusive of a substantial panelled base, can, if the rail is taken at scrap value, be erected complete for £6 each.

If a rail is set in its concrete foundation with the usual amount of rake, but before any of the casing concrete is applied, it will stand a tension of 2,000 lb. applied 21 ft. from ground level, with a temporary deflection of 11 in., no permanent set occurring.

Having decided to use a trolley wire which on straight track would give a load per span of 313 lb., as against 232 lb., for four wires each of 4/0 gauge, the reinforcement of the existing poles required special attention. Steel rods having a tensile strength of 35/40 tons, in lengths of 30 ft. 6 in., were used, three to each pole.

These high-tensile steel rods were bought at £9 10s. per ton delivered. It is not generally known that plain round rods are quite satisfactory. I understand a ½ in. rod, set for a length of at least 18 in., in good concrete, will break before it can be pulled out. Quick-setting cement and clean sharp grit, in proportions of 1—3, were used. A gang of three men can reinforce at least three poles per day at a cost of about 25s. per pole.

It is desirable not to rely on the grout dropping solidly into a homogeneous mass, but to work out any trapped air or voids. This can be done by putting down the pole a set of ordinary drain canes, which can be used to tamp the grout after each bucketful is poured in, lengths of the canes being unscrewed as the level rises.

After experimenting with different types of trolley wheel the solution appeared to be a wheel running on ball bearings, having a rather soft centre, with hard flanges and hub.

At times 250 amperes are passed through the heads, but it was ultimately found that by using a high-conductivity carbon brush bearing on the side of the wheel as a collector, the difficulty was solved, and the balls and races would keep in perfectly good condition for a sufficient period to make the design worth while. A head having two sets of balls, one for the fork and the other for the wheel, is a practical project. They run quite sparklessly, and are cheap in maintenance costs, as only the centres are subject to much wear. The wheels run on standard front-wheel push-bike spindles and cones.

In presenting his paper, the author emphasised the tremendous reduction in the congestion of traffic along the front and in the narrow streets of Hastings by the adoption of trolley 'buses, notwithstanding there had been a considerable increase in the volume of general traffic on the streets. Whereas with the old trolley tramway system with single lines and passing places, the average speed was about 7½ miles per hour, it had

now been increased to 10.36 miles per hour, whilst in the more open parts of the system the average was as high as 13.20 miles per hour.

Discussion.

Mr. A. R. Hoare (director of the Hastings Tramways Co.), who paid high compliment to the manner in which Mr. Edwards had carried out the conversion in Hastings without interfering with the running of the system, said experience had shown that the steeper the gradient the better did the trolley 'bus compare with the petrol 'bus. He also called special attention to the open-top trolley 'buses in Hastings as a special feature not to be found elsewhere.

Mr. W. Vane Morland (general manager, Walsall Corporation Transport) raised a question as to the reinstatement of roads where trolley 'buses replace tramways. Under the old 1870 Tramways Act it was stated that under such circumstances the roads should be put in a condition no worse than they were before the tramways were laid. Many local authorities, however, were asking that the roads should be reinstated on the most modern principles, which were very different from the state of the roads before the tramways were originally laid. Indeed, in some cases this was demanded as a condition of consent to the conversion. He asked what the author considered the safe maximum speed for a trolley 'bus on a straightforward road and what were his views as to the use of tandem motors as against single motors. Further, had the author reason to think that with tandem motors and regenerative control better results would be obtained? It was not quite fair that trolley 'buses should be rated in the same way as tramways.

Mr. N. Clough (Messrs. Clough, Smith & Co., Ltd.) expressed the view that in any conversion scheme of this nature it was better entirely to reconstruct the overhead system also, rather than modify the existing overhead equipment which had been up a good many years. In many cases the existing poles had been seriously weakened by corrosion and should be scrapped. The author was apparently using two different thicknesses of trolley wire, but that was likely to cause some difficulty with the trolley wheel, which usually had a groove equivalent to the diameter of the trolley wire; with two diameters of wire the trolley wheel would be worn in two places. Instead of using a large negative and a smaller positive he suggested the use of two large negatives or two medium size positives with a negative feeder erected on the side of the posts, which would reduce wear of the trolley wheels.

Mr. D. E. Bell (general manager, Yorkshire Electric Tramways, Ltd.) said he had carried out a conversion scheme, but as a company having to purchase its power from a municipality he felt the prices charged were too high. The average price was not less than 1d. per kWh, and it was often between 1½d. and 2d., which was higher than that charged by municipal electricity departments to their own tramway departments. The author was fortunate in having his own power station. He enquired whether the author had received any complaints as to interruption to broadcasting. His experience was that this arose chiefly from the rails, and with the removal of the rails the trouble was largely minimised.

Mr. H. R. Beasant (Bristol Tramways and Carriage Co.) did not agree with the author that the trolley 'bus had a higher maximum speed on the level than the petrol 'bus. It was possible to get a higher schedule speed, but not a higher running speed, under suitable conditions. The trolley 'bus, however, scored in its own field by reason of its greater acceleration and automatic adjustment of speed to the conditions. He did not agree with the use of two different sizes of trolley wires, because it led to difficulties on the part of the storekeeper and also the linesmen. There was need for greater attention to the design of the trolley head of a trolley 'bus than in the case of a tramcar because of the higher speeds and larger currents. He asked what was the life of the carbon brush in the wheel and how would it affect the maintenance costs.

Mr. W. McGibbon (general manager, Mexborough and Swinton Tramways Co.) said there were one or two points on which from his experience of converting to trolley 'buses he differed from the author. For instance, a 6/0 wire was very difficult for the linesmen to strain, and he had adopted a 4/0 wire, which was quite satisfactory. There was a great difference in the braking required on a trolley 'bus and on a petrol 'bus owing to the braking effect of the engine in the latter case. He believed the author had hoped to obtain considerable saving in power from regenerative braking and it would be interesting to know the actual saving.

Mr. W. E. Warrilow (New Distributors of Edison Accumulators, Ltd.) remarked that the electric battery vehicle was bound to come, and that the trolley 'bus would easily be convertible, using the same motors and vehicle equipment perhaps and rewinding of the motors only. In the meantime, he suggested the use of battery vehicles, using a trailer for carrying the battery, as feeders at the ends of trolley 'bus or tramway lines. At present the best that could be done was 16 watt-hours per lb. of complete cell with a steel alkaline battery, but that would be materially improved at no distant date.

Mr. C. R. Tattam (Messrs. Balfour, Beattie & Co., Ltd.), asked if the author had made comparisons with trolley 'buses similarly loaded and over the same route, first with regenerative control and then without it.

Mr. R. H. Campion (General Manager, Torquay Tramways Co.), described a different method of erecting poles to that mentioned in the paper and referred to difficulties encountered with trolley 'bus systems where insufficient provision had been made for the return.

Mr. B. England (General Manager, St. Helens Corporation Tramways), after some references to turning point and curve construction, said he did not think they need fear the storage battery vehicle at the present moment any more than they need fear radio control. It would be interesting if the author would give some results of his experience with six-wheeled vehicles, as to costs and troubles, if any, particularly with back axles, as compared with four-wheeled vehicles.

Mr. F. A. Garrett (Ransomes, Sims & Jefferies, Ltd.), asked whether there was any greater wear and tear on the transmission of trolley 'buses fitted with regenerative control. Two or three years ago the general size of motors for trolley 'buses was 65 to 70 h.p., but now it had gone up to 80 h.p. and inquiries were coming in for 100-h.p. motors.

Mr. W. A. Stevens said all the motors on the Hastings trolley 'buses were fitted with single motors. The field winding was in two, one series winding and one shunt winding, the former having about twice as many turns as the latter. As the vehicle speed increased, after starting up, the current through the series winding naturally decreased, and when the vehicle had reached a speed at which the counter electromotive force of the motor was equal to that of the line of course there was no current passing through the machine at all, except through the shunt winding. When the vehicle was descending a hill, the counter electromotive force of the motor exceeded that of the line and current went back on to the line. In the early machines the current which went back on to the line had to go back through the series winding, which set up a counter magnetomotive force which weakened the series fields, so that the current returned to the line was limited to 60 amperes. Within the past 12 months, however, an arrangement had been fitted to some of the vehicles so that when regeneration took place the series winding was short circuited, and in that way as much as 180 amperes could be returned to the line when running down a hill, without the use of the mechanical brake at all on the vehicle. Resistance was automatically brought into circuit, thus preventing any increase in voltage on the lamps when regeneration was taking place.

Mr. W. T. Robson (Equipment & Engineering Co., Ltd.), said that the advantages of trolley 'buses were so enormous that it was difficult to understand why any small tramway undertakings at any rate remained in existence. It was vital to get all the old single-line tramways systems with passing places off the road as quickly as possible. He suggested that in laying out a trolley 'bus system, due regard should be had for the amenities of the district and the layout of the overhead equipment should be arranged accordingly.

Mr. L. E. Harvey (Manager and Engineer, Ilford Corporation Tramways), suggested that the Overhead Committee of the Municipal Tramways and Transport Association should be made use of by members of both bodies. That Committee might undertake advising those who were contemplating a lay-out for trolley 'buses.

Mr. Harry England (Managing Director, Yorkshire (West Riding) Tramways Co.), recalled that in connection with some of the Bills before Parliament borough engineers and surveyors had suggested that no poles should be permitted on account of the danger to motorists. They had contended that the motorist should even be allowed to run on the pavements and therefore there should be no poles there. The erection of poles was a big stumbling block in connection with trolley 'buses. He was convinced the public liked trolley 'buses, and congratulated the author on the very efficient and neat lay-out of the system in Hastings.

The Chairman, in the course of some comments on the paper, before the reply was given, spoke of the cheapness of reinforcing existing poles and raised the question of the advantages of the turning circle at termini as compared with the Vee. He rather favoured the latter unless there was room for a very large circle. The trolley wheel in Hastings, he added, seemed rather elaborate.

Mr. W. V. Edwards, in the course of his reply to the discussion, said the open-top deck trolley 'bus had been specially designed for Hastings visitors, who made use of them for joy rides. As to road reinstatement, mentioned by Mr. Vane Morland, a special arrangement had been made with the Hastings Corporation and no trouble had arisen in his case. The trolley 'buses could travel 40 miles an hour safely on the level. The great feature in increasing the average speed was so to arrange the junctions and points that the vehicles could pass through them without undue reduction of speed at those places. He did not see any reason for a difference in rating tramways as compared with trolley 'buses. The rates were levied on the financial returns and it did not matter whether the profits were made with a system running on rails or not. As to galvanised wire, he was using " Crapo " wire, which was excellent and could be nozzled off beautifully. Concerning the remarks about two sizes of trolley wire, he did not think there was much likelihood of complication there. In one case in a depot the 4/0 wire had been replaced by a 6/0 wire, but the drivers did not notice any difference. The generating cost in the Hastings Company's power station was 0.7d. per kWh. With regard to broadcasting complaints, on one occasion when some trolley wires were erected along the front without any connection at either end there were complaints of interference. A short time later the wires were connected up, and the complaints vanished. He believed that any trouble of that nature could be cured without touching the trolley system at all. It was the intention to change all the negative wires over to 6/0 in due course, but some of the old 4/0 tramway wires still had good service in them and they were being allowed to remain.

Electric Furnaces.

The development of the high-frequency induction furnace for the production of steel on the crucible principle.

IN a paper read before the Manchester Association of Engineers, Messrs N. Ryland Davis, M.A., and C. R. Burch, B.A., describe a small induction furnace that has been developed by Metropolitan-Vickers Electrical Co., Ltd.

The authors refer to the four main classes of electric furnace which can be roughly compared with fuel-fired furnaces. First, there is the type using independent resistance elements, in which electrical energy is dissipated, the charge itself being heated by radiation and convection. Such furnaces have never become very popular for melting, their chief applications being the comparatively low-temperature operations of annealing.

In the second form of furnace the metal itself, confined in a channel of suitable shape, forms the resistor element. This channel forms the secondary of a transformer. In these circumstances the attainable temperature is limited either by the boiling point of the molten charge or by the refractory of which the channel is made. The latter limitation has prevailed up to the present, and the furnace is used almost entirely for melting brass. It is the most efficient electric furnace ever made. When melting 60:40 brass the power consumption is of the order of 240 kWh/ton; when convenience, repairs, labour costs, quality of the product, and metal losses are taken into account, it is said to show a saving of nearly £1 per ton over the older methods. A particular arrangement of this type of furnace invented by James Wyatt is almost universally employed. It is worthy of note that over 50 per cent. of the sheet-brass made in America is melted in such furnaces, and in Great Britain over half a million pounds of brass is melted per day in this type of furnace.

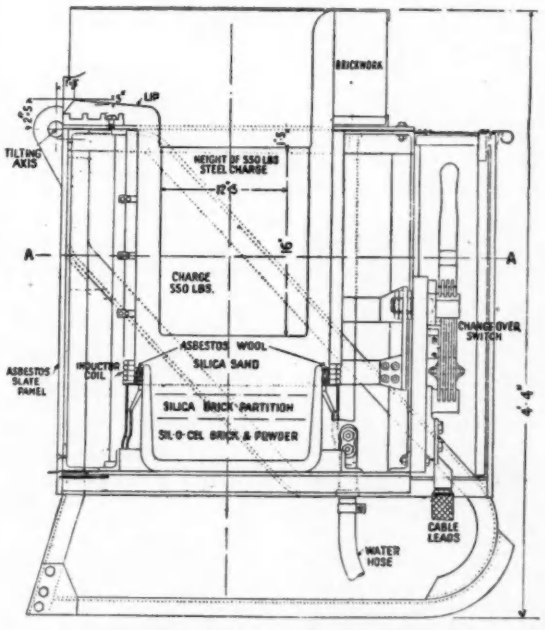
The manufacture of mild-steel by the basic open-hearth process, costs for the finished product £6 to £7 per ton. The melting cost is of the order of 30s. and no considerations of quality or convenience can be adduced which would justify an addition to the price. In this field, which represents at the moment 99 per cent. of the world's steel production, the arc furnace is definitely excluded on the score of cost alone.

Stainless steel (15 per cent. to 20 per cent. chromium) was originally made in very small quantities in the crucible, and the products sold at so high a price that melting costs even of £20 per ton were not prohibitive. As an engineering demand grew and larger ingots were called for, the arc furnace was pressed into service. This enabled ingots to be made up to 20 tons, and reduced the melting costs by perhaps £15 per ton—about 10 per cent. of the selling price. With the present price of ferrochrome, and using the present process, even if it were possible to make stainless-steel in the open-hearth, a saving of not much more than 1 per cent. would result. We may expect, then, that the arc will hold its sway in this field, until the other contributions to the cost of manufacture have been reduced to such an extent that the melting cost again becomes significant. As the demand arises for larger and larger ingots of chromium-steels, it is not at all clear whether the demand will be met by the development of larger arcs, or by a more determined attack on the problem of melting chromium alloys in the open-hearth.

Even if all alloy-steels were made in the open-hearth, there would still be difficulty in disposing of turnings and borings which can only be charged into the open hearth in small quantities. The arc displays considerable avidity for this type of charge, and in making alloy steels from turnings and borings it will always compete with the open-hearth making the same alloy from virgin metal.

There is very little doubt that steel made in the crucible is better than steel made in the arc or in the open-hearth. Where small quantities of the best possible steel are required, the crucible process will always have preference, despite the fact that the melting cost is three or four times as great. We will consider one case, that of 35 per cent. cobalt magnet steel. Here the price of the raw material alone is over £300 per ton; the material is usually required in the form of small castings and there is thus no incentive to risk the development of a process for melting £1,000 worth of metal in one charge in order to achieve a possible saving of 2 or 3 per cent. in the price of a finished product, which must, in general, be of inferior quality. During the last few years an electric furnace has been introduced in which it is possible to make steel as good as, if not better than, crucible steel, and, moreover, at a cost comparable with melting in the arc. This furnace, a form of induction furnace, has, in fact, removed the last argument which could be adduced in favour of the crucible process.

It has influenced the economics of alloy steel production in three ways. First, it has reduced the cost of melting high quality alloy steels by about £10 per ton and permitted us to visualise the possibility of crucible-quality ingots weighing several tons. Second, it provides, at the present ruling prices, a method of melting certain low carbon alloy scraps more economically than with the arc, in which it is difficult to avoid a carbon increment without loss of chromium. Finally, it has rendered possible the production of carbon-free alloys, of which "permalloy" is perhaps the most important example.



Construction of H.F. Induction Furnace.

For years the engineer has deplored the fact that when a piece of metal is placed in an alternating magnetic field it gets hot, but only quite recently has serious attention been given to the problem of designing large-scale furnaces working by virtue of this fact. The readiest way of applying this principle is to take a crucible and place it inside a coil carrying alternating current, and this, indeed, is what is done.

160 kW will melt a ¼-ton charge in less than an hour, but the furnace will have to be supplied with current at some frequency ranging from 500 to 2,000 cycles. The power factor will be bad—of the order of 0.15—and it will be economical to supply about 1,000 kVA of condensers. There will be considerable mechanical forces operating on the liquid bath, which will be well up in the middle to a height of perhaps two inches, flowing outwards and down at the sides.

The authors consulted metallurgical opinion regarding a 10-lb. laboratory induction furnace which it was proposed to make and they were assured that it was desirable to be able to lift out the crucible for pouring, as only in this way would it be possible to simulate the teemer's skill. To pour through a funnel and thus ensure hitting the bottom of the mould was criticised on the score of chilling the metal, and they were not to be allowed to superheat the metal, on the somewhat mysterious grounds that this would "burn" it.

They proceeded to construct, not only a 10-lb. furnace, but a ¼-ton furnace, and showed that the traditions of the crucible could be disregarded. They still maintained that it was essential to hold the metal molten for a period of an hour or so, the argument apparently being that only in these circumstances could the gas bubbles and slag particles be expected to rise to the surface, and a "dirty" ingot be avoided. Had this proved true, and even had it been possible, without endangering the refractories, to provide the superheat (about 300 deg. C.) necessary to keep the metal molten for an hour, the resultant halving of output, which would nearly double the melting costs, would have removed the principal competitive advantage in comparison with the older process, and it might even have brought the development to an end. It was feared that the fountain would disperse particles of slag throughout the mass, and that only a long period of quiescence would allow of their removal. Actually, when the furnace is in operation, one can see particles of foreign matter appearing from time to time on the surface of the metal, and being carried by the circulation towards the sides where they adhere to a gradually forming ring of molten slag. This, then, is the

reason why perfectly clean metal can be poured from the induction furnace almost as soon as the metal is molten.

Apart from these differences of technique, the outstanding physical difference between this and any other process of steel manufacture is that no attempt is made to prevent a fairly free access of air to the charge during the whole of the operation. It is found that if iron containing only carbon is melted in air a steady evolution of gas takes place from the molten bath and a further evolution occurs during solidification. If the bath is maintained liquid, the gas evolution continues until the carbon content falls to a very low value (below .05 per cent.). The metal, however, is not quiet in the mould. It is essential in all but the poorest quality steel that blow holes, due to gas evolution, be avoided. The metal must be quiet in the mould. If now, carbon-free iron is melted in air, it is quiet, both in the bath and in the mould. The gas evolved must, therefore, be the result of a reaction between the carbon and the iron oxide in the bath. If we add to the molten bath some material which has more avidity for oxygen than the carbon, we can eliminate the oxides in the bath and the evolution of gas will cease.

When steel is melted in the crucible process, although there is very little oxide present, the metal must be supposed to be saturated with carbon monoxide, and therefore the instant it has been removed from the pit-fire it is identical in condition and composition with a melt made in air, to which just enough deoxidiser has been added to remove the dissolved iron oxide. Both melts would evolve CO during solidification, and a further addition of deoxidiser is necessary to remove the CO present, and also any oxygen which may be absorbed from the air.

It was suggested that if the metal were superheated considerably its quality would be seriously impaired. Had this proved true, it would have detracted considerably from the flexibility of the furnace when used to make small castings, which must be poured from a ladle, an operation taking a considerable time. That the metal should remain hot in the ladle for sufficient time requires a considerable superheat. Such practice, however, is now standard in steelworks. Fear for the refractory alone dictates the maximum temperature to which the charge can be raised, and so far as the authors know metal has never been harmed in the induction furnace by superheat.

Combined Heating and Lighting.

Depicting some Examples of the Apparatus introduced by the Morgan Crucible Co., Ltd.

A NEW system of electric heating by radiation was described in an article in our issue of July 26th, 1929, the special radiators employed taking the form of panels either suspended from ceilings or fixed high up on walls, and examples were given of installations which comprised a number of independent "Morganite" electric radiators arranged so as to produce a uniform distribution of radiant heat and comfort. Where such an arrangement of several radiators is permissible, the system is both effective and economical. An occupant of any room loses heat, both by radiation to colder surrounding objects and by conduction to the air, the proportion (roughly 6 :4) varying according to the temperature of the air, walls, ceilings, &c., and to the extent of draughts, but in any case in which the combined loss exceeds the normal rate for a healthy person a feeling of "cold" results. This can best be prevented, it is claimed, by exposing the person to radiant heat, as its action is quick, and comfort can be obtained in lower air temperatures, thus giving bracing conditions and reducing the heat loss from the building. In designing installations of this kind, the main object is to produce a uniform distribution of radiant heat, and, in doing so, the aggregate effect of the radiant heat received at any one point from every radiator has to be worked out.

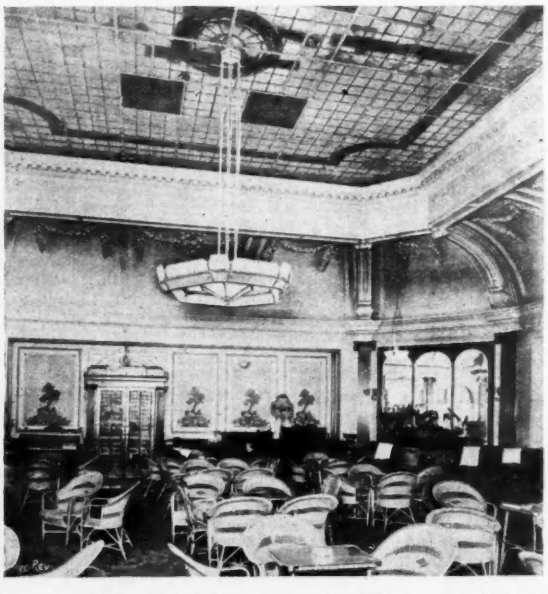
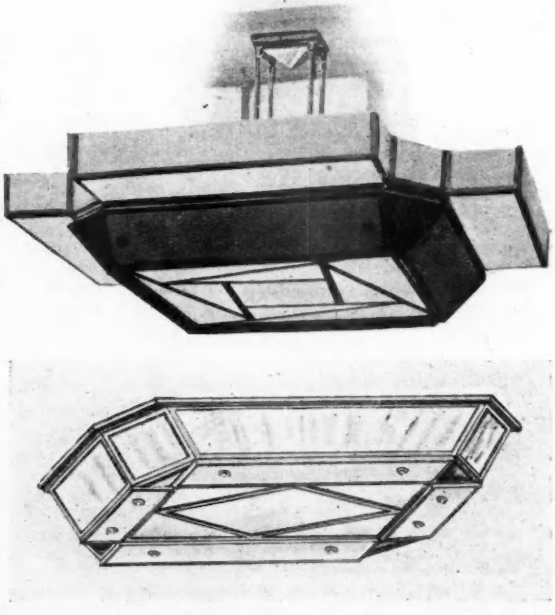


Fig. 1.—Combined Heating (6-kW) and Lighting Fitting in Palace Hotel, Bloomsbury.

In many public places, such as theatres, restaurants, hotel-lounges, &c., the use of a large number of ceiling- and wall-fixture models to give the required heat distribution would be ruled out on account of appearance alone, and it is then necessary to modify the system by suitably grouping together several "Morganite" heating elements on one mounting, each element having a different orientation. The natural development of this has been the combined heating and lighting pendant, which affords a simple and satisfactory solution of the difficult problem of supplying heat to the centre of large floor spaces.

In the fitting illustrated in fig. 1, twelve 25-in. by 5-in. heating elements are mounted so as to form two concentric rings back to back; the loading of each element is 500 watts, making a total of 3 kW for each ring. The elements are usually mounted at an inclination of about 30 degrees to the vertical, but the angle may be varied according to the area over which the radiant heat is intended to fall. For example, in small halls or lounges where one pendant may be sufficient, the inclination should be just enough to bring the foot of the walls well within the heated zone. On the other hand, where a number of pendants are required, the angle may be reduced so as to throw the radiant heat more obliquely over a wider area. This arrangement produces a more uniform distribution of heat than by localising the effect of individual pendants to separate sections of a floor space.



Figs. 2 and 3.—Decorative Designs of Combined Heating and Lighting Units.

This system lends itself to a wide variation of design, both in regard to the number and shape and orientation of the elements, in addition to the lighting effects, which can in all cases be admirably adapted for different requirements, without interfering with the heater design. In the case of an hexagonal fitting, alternate elements in both the inner and outer rings may be switched off without seriously impairing the radial distribution of heat, and a wide range of heat control is therefore possible.

The units illustrated were designed and manufactured by Mr. F. H. Pride, and they incorporate "Morganite" electric heating elements.

Electrical Development: A Proposal.

The author advocates that complete electrification should be encouraged in a definite, whole-hearted manner as a means of cheapening building costs and eliminating the smoke evil.

By BEN QUARMBY.

FROM my window I can see six chimney stacks, each stack being fitted with six chimney pots, and most of these are belching forth smoke from early morning until late at night. Multiply this by several millions, and you have a fair estimate of the damage being done to the atmosphere, and of the magnitude of the contribution of our dwelling houses to the smoke nuisance.

The Minister of Health, in his opening speech at a recent Health Exhibition in Manchester, stated that he "had not burned raw coal in his own house grate for many years," while the late Sir William Milligan, the eminent Manchester surgeon, at the same exhibition, drew our attention in grave words to the serious effect of smoke on health. One would have thought that these statements would have influenced the Minister in his work in connection with the housing problem, and stimulated in him a desire to help the people of the country to have available the privileges which he himself enjoys. Yet we look in vain for any such attempt, and find that all the new housing schemes to which he is giving his approval are on the same old orthodox lines, with chimneys and provision for the consuming of raw fuel. Surely if it is considered desirable to eliminate smoke from the atmosphere, the obvious thing to do would be to prohibit the erection of chimneys, and the provision in new buildings of means whereby raw fuel could be consumed, and to make available under desirable conditions a means of providing the necessary heat and light by a more suitable medium, fulfilling the required conditions as to absence of smoke, convenience, and cleanliness, and ease and economy of distribution.

Electricity is the only suitable medium fulfilling all these conditions, and should therefore be given more consideration in connection with new housing schemes. Electricity does not require a chimney; gas fires require an outlet, and are unhealthy, only appearing useful to me as a means of terminating an undesirable existence; gas stoves fulfil the same purpose admirably, and also require an outlet for the poisonous fumes. Many so-called smokeless fuels and fires are a perversion of the truth in advertising, and were it not for the chimneys would find short shrift with their users.

Subsidies have been given by various governments, and for various purposes; none of these to my mind would give so much satisfaction generally, and fulfil so admirable a function, as a *subsidy for all-electric houses*. Some encouragement should be given to all-electric houses, on account of their contribution to the general good, and their assistance in the abolition of the smoke nuisance, and I submit the following form in which it would be acceptable to countless thousands: (1) New all-electric houses, built without chimneys and guaranteeing to consume no other fuel for any purpose, to be allowed ½d. per kWh rate, through one meter for all purposes; (2) The same terms to be allowed to occupiers of existing houses, giving the same guarantee, and agreeing to remove all chimneys, fires, gas fires, &c. Meter rents would be abolished. By this means the present cost of building would be reduced in many ways.

In every locality building such houses would help to increase the electricity load, and assist in cheapening the cost of administration of the supply. The widespread adoption of a one meter system would effect economy in connection with meter reading, and also in the simplification in accounting made possible by the adoption of one tariff. The one meter, one tariff principle would be easily understood by all, and the mistrust and dissatisfaction which exists with the present system would vanish.

Local electricity committeemen would welcome, and no doubt act on, such suggestions, availing themselves of the advantages offered, thus becoming, perhaps for the first time, able to speak from first-hand knowledge of the uses and advantages of electricity.

The electrical trade generally would also, I am sure, welcome such an innovation. It would raise the status of the contractor, and much would be done to eliminate the jerry contractor and amateur wireman, for the installation work necessary in the complete all-electric house would be too complicated and technical for any but a competent man.

The sun would shine on the canvasser, and for the first time in his career he would have something tangible to offer, other than a confusing mass of explanation regarding the different tariffs for different purposes. Economy could easily be effected in the costly mains department, as more consumers would be obtained on any extension by the added inducement than are at present obtained by a canvass, and we should not see so much of the repeated taking-up of streets for each additional consumer.

Perhaps the greatest fillip would be given to the manufacturing side of the electrical business, as with the national adoption of a cheap rate, and the increase of all-electric houses, many new departures and different designs of apparatus would be possible. Much could be done to make many appliances more satisfactory, when the basis for re-designing them was a cheaper rate. I can also foresee new applications of electricity to many purposes with the introduction of a cheaper rate, and with the inducement of a wider market.

There should then be no difficulty in designing a system of central electric heating for private houses, using electrically-heated water, circulated through pipes and small radiators, with draw-off taps for hot water at the bath and the kitchen sink, assisted where necessary by an electrically-driven pump, for circulation.

Such an innovation would be a boon to the private house, and it would be a very simple matter to maintain an even temperature by thermostatic control.

I am firmly convinced that there is no other of our essential services, the development of which would assist in securing so many advantages for the benefit of the people of the country generally as electricity, particularly when this development embraces the conservation of our fuel supplies, and the prevention of the waste of raw fuel.

Another feature of the suggestion is its double-barrelled nature, in so far as it would have a beneficial effect upon employment as well as upon health. For this reason I would suggest that the granting of the facilities proposed should be conditional on all appliances used in the all-electric house being of British manufacture, and that American refrigerators and washing machines and German irons and appliances should be forbidden.

The same terms and facilities could later be given to business premises, schools, workshops, and small factories able and willing to give the same guarantee. This I feel sure would result in the adoption by many factories of an electric heating system, the installation of which would enable many to become eligible for the ½d. rate, leading to the abolition of more and more chimneys. Many workshops would electrify their machines and processes to make themselves eligible, opening up new and wide avenues in the electrical trade, and contributing to our national welfare in many ways.

Building operations are now proceeding apace, and in many parts of the country the operatives are working overtime, all helping, with the connivance of the builder and the Minister of Health to perpetuate an evil by the erection of chimneys Now is the time, and here is the method, to put an end to this evil. The electrical trade and its associations should give consideration to these proposals, and press them whenever and wherever possible, with a view to their speedy adoption for the national welfare.

The Almeida Accumulator.

The Almeida accumulator (the Spanish invention to which reference was made some time ago, and for which several startling claims were made) is apparently still in the experimental stage. Patent Office records show that a further patent has lately been issued to Senor E. Almeida in conjunction with Almeida Accumulators, Ltd., of Aldwych House, Aldwych, London, W.C.2, for a battery electrolyte consisting of zinc chloride, potassium bromide, and sufficient hydrochloric acid "to give a slight acid reaction to congo red paper with or without a small quantity of mercuric chloride, *e.g.*, 20 grammes per litre."

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Electric Winch.

A silent worm-geared electric winch, fig. 1, which has recently been introduced by METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, is complete and self-

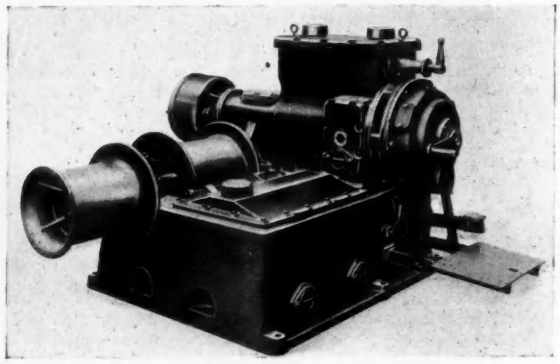


Fig. 1.—The New " M.V." Ship's Winch.

contained, all the electrical apparatus being built into the winch carcase to form a water-tight deck-mounting equipment, ready for direct connection to the ship's mains. The number of bolted facings has been reduced to a minimum, thus cutting down the number of joints to be kept water- and oil-tight. The winch has a centre hoisting barrel and one or two warping ends as required, all keyed to a large-diameter shaft running in phosphor-bronze bearings. The electrical components of the winch, namely, motor, master controller, contactors, and resistances, form separate units which are mounted in the winch casing, and are readily accessible for all running adjustments. The several units can be easily removed when a general overhaul is made. The drum shaft is driven through a worm reduction gear which runs in an oil bath and is housed in a water-tight casing of the winch. The combined worm shaft and armature spindle runs in ball bearings at each end, the bearing at one end taking the thrust of the worm. Three brakes are provided: a magnetic disk brake, a centrifugal one, and a foot brake. All the brakes are totally enclosed and water-tight, and they act independently. The magnetic brake operates automatically, being released when the motor starts and applied when the current is cut off. A handle is provided for releasing the brake in order to lower by gravity. The winch is controlled by a group of contactors that are housed in the bedplate and governed by a small master controller. The speed and sequence of operation of the contactors are automatically controlled and are independent of the rate at which the controller handle is moved. The controller handle can be thrown rapidly from full-speed hoist to full-speed lower, or *vice versa*, without damaging the electrical gear. A load discriminator automatically increases the speed of lifting as the load is reduced, and with a light hook from 4 to 4½ times full-load speed is obtained. An interlock switch in the controller is mechanically coupled to the foot brake. Bolted doors are provided wherever necessary for access to the mechanical and electrical parts. All parts of the winch are suitably protected to resist the corrosive action of sea air and water. There are two standard sizes, with normal working loads of 3 and 5 tons, respectively.

Improved Batteries.

The FULLER ACCUMULATOR CO. (1926), LTD., Woodland Works, Chadwell Heath, Essex, recently introduced a new range of " Sparta " batteries for which some important and exclusive features are claimed. Grease-cup terminals are fitted, and double grease barriers remove the trouble experienced through corrosion between the terminal post and the terminal clamp occasioned by acid creeping up the post. Internal short-circuiting is prevented in the " Sparta " battery by patented plate protectors. These are channel-shaped strips of ebonite, which envelop the edges of the plates, and thus insulate the edges of each plate from those of the next. The plates are pasted with micro-porous paste, which has almost the structure and coherence of a solid. The special process of incorporating this paste into the plate frames of pure antimonial lead results, it is claimed, in plates which have great strength and life, rapid recuperative power, and freedom from shedding of active material.

A Car Battery Booster.

RUNBAKEN MOTOR & ELECTRICAL ACCESSORIES, LTD., Ardwick, Manchester, have recently brought out a device for boosting up starter car batteries without removing them from the cars, simply by inserting a plug into the inspection-lamp socket found on most modern motor vehicles. At one end of the device is a bayonet or pin-plug connection for the house supply, and at the other the connection for the battery. On top of the case is a two-way knife switch giving 6 or 12 volts, as required. An ammeter shows the charging rate, and an ampere-hour meter the actual charge the battery has received. At one end is an off-and-on switch, and at the other end a switch that looks after polarity. Thus, if the battery is plugged in the wrong way round, the polarity switch falls out, and the plug must be reversed. There is thus no possibility of discharging the battery through wrong connections.

A Large Planing Machine.

The accompanying illustration, fig. 2, shows a " Stirk " patent " Hiloplane," 12 ft. 6 in. wide and 28 ft. long, recently supplied to the Royal Arsenal at Woolwich by Messrs. JOHN STIRK & SONS, LTD., Ovenden Road, Halifax. Among improvements embodied in the machine is a double-plate table with openings in the sides for removal of cuttings which may pass through the holes in the top plate into the interior. The total weight of the machine is approximately 125 tons, the bed being in three sections with tongued and grooved joints crosswise, and the table in two sections jointed lengthwise. It will be seen that the cross slide heads are spring balanced, and they are entirely independent, both as to direction and amount of feed. The drive is by " Stirk " split-field equipment of 90 h.p. planer rating, through keyless steel driving gears and twin racks. The feeds are by the " Stirk " electric system, with turn and half-turn motors and suitable gear changes. The control of the stroke is by a disk and master switch by which alterations of a few inches or a few feet are made with great facility. Automatic cross and vertical planing can be accomplished, the stroke in each case being controlled by the same disk and master switch as the main table movement. Electro-magnetic tool lifters are provided,

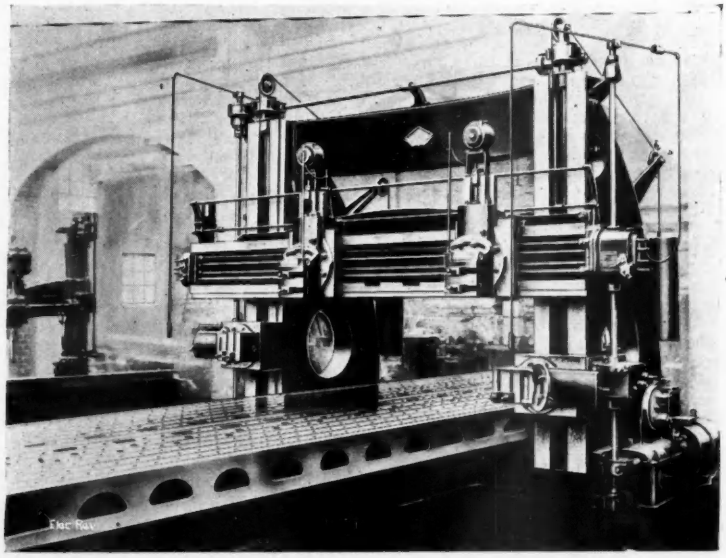


Fig. 2.—The 125-ton Electrically-driven Planer at Woolwich Arsenal.

which also accelerate the table motion. The control is by three-decker balanced pendant switches, one at each side of the machine, and from these two flexible points the table may be started, stopped, and inched in either direction, and the heads also moved in either direction. Electrical interlocking is provided between the pendant control for power traverses and the automatic electric feed.

A similar machine of rather greater capacity than the one illustrated is at present being constructed by Messrs. Stirk and Sons for one of the leading electrical works on the Continent.

New Electric Lamps.

Messrs. BERTRAM B. FENN, LTD., "Fenbo House," Great Chapel Street, Oxford Street, W.1, have recently introduced a range of electric lamps which are the result of a method of moulding the actual glass into a series of fine modulations or crystals, which so disperse the rays, it is claimed, that glare is entirely and permanently eliminated. It is also claimed that the crystals, in addition to fusing the light, magnify it.

Electrically-controlled Steam Valves.

During the past few years Messrs. HOPKINSONS, LTD., of Huddersfield, have devoted special attention to the self-contained electrically-operated steam valve, and they now have a complete range of such valves for d.c. and a.c. supply and suitable for all pressures. The arrangement includes positively-operated limit switches of special design, housed in the main casing, which control the travel of the valve spindle, one feature being that no trigger springs are used. There is a positive magnetic-clutch device which comes into action when the small electric motor has attained full speed, and this results in a blow or jerk being given, so that the valve always commences to open at once. In addition, the valves can be operated by the ordinary handwheel as usual, when desired, without disconnecting the electrical gear, since when the electrical motor is not running, the automatic clutch disconnects the drive. The valves are suitable for pressures up to 900 lb. per sq. in., and for temperatures up to 850 deg. F., while special designs are available for higher limits. The motors are generally mounted direct on the valve, but they may also be fixed alongside on a separate column. Various methods are available for operating the valves from the control panel, and often a small reversible drum controller is used, having a dial showing the actual position of the valve as regards opening or closing. In another arrangement, the panel is provided with push buttons for "open," "shut," and "stop" positions, that is, the valve may be completely closed, completely opened, or held up in any intermediate position. Emergency panels are usually arranged for "shut" only, but any desired arrangement can be embodied to suit the individual conditions. One important feature also of all the systems installed by Hopkinsons is that once a push button is operated it remains in the "operative" position until the travel is complete, or the "stop" button is brought into operation. There is no need to keep the button pressed once the movement has started, and when the limit switch breaks the circuit the button returns to its normal position, thus indicating that the whole circuit is operating correctly. The same principles are adopted for the

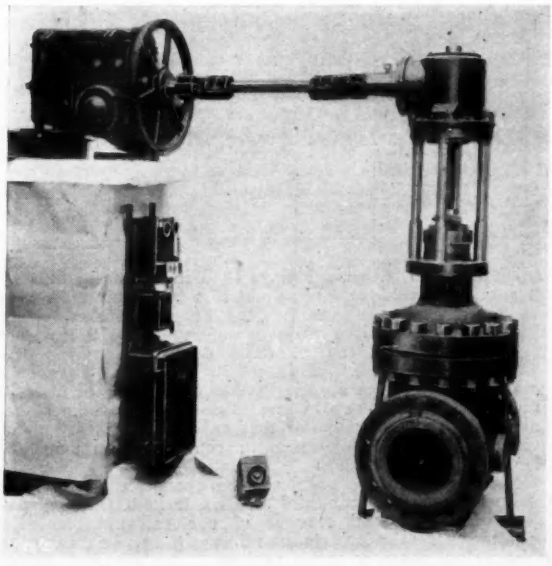


Fig. 3.—Electrically-operated H.P. Parallel Slide Valve.

company's new engine-room telegraph now being installed, for example, at the new Kirkstall power station, Leeds. The above illustration, fig. 3, shows a h.p. parallel slide steam valve for electrical operation through bevel gearing with push-button control and an emergency close button.

A New Gate-end Switch.

Our attention has been called to the "F.S." air-break fuse-type gate-end switch recently introduced by BRITISH JEFFREY-DIAMOND, LTD., and specially designed and constructed for duty under diverse conditions. From the accompanying illustration, fig. 4, it will be seen that the whole mechanism and moving contacts are attached to the lid, so that it is impossible for the circuit to be closed with the lid open. In addition,

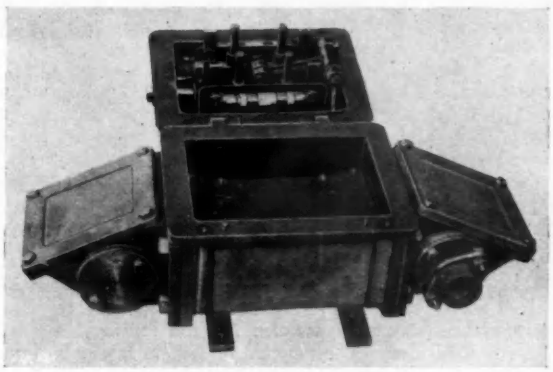


Fig. 4.—"Jeffrey-Diamond" Gate-end Switch; "Open."

when the necessity arises for changing the fuses, it is only possible to do this with all parts "dead." The fuses can be either of the cartridge or re-wireable type. The mechanism is totally enclosed within a close-grained cast-iron flame- and explosion-proof case possessing wide machined flanges which fit accurately face to face. The fuses are carried on the moving contacts which, in turn, are mounted on mica insulation. Detachable contact bars mounted in the box provide ready means for making quick and effective incoming connections, and these bars are covered by arc-resisting material which also serve the purpose of protecting the contacts from casual touch, and the cooling effect causes the easy suppression of the arc which may be formed. An effective high-speed "make and break" is ensured by the use of strong springs, and the tendency to "draw" the arc is, it is claimed, entirely eliminated. Local metallic parts are free from excessive heating up, and the special design of the contacts allows burning or pitting to occur only at points away from the actual contacts. The standard design of the switch is made for 50 A, but modifications can be made suitable for up to 150 A. Efficient interlocks make the equipment foolproof, it being impossible to open the lid when the switch is in the "on" position or to close the cover to give electrical contact without first returning the mechanism to the "open" position.

Combined Charge Collector and Fire.

A recent development by ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10, of the "Utility" hotel-fire charge collector, which we described in this section in our issues of November 15th and December 20th, 1929, pp. 874 and 1112, is a combination as one unit of the charge collector and the makers' "Riviera" fire. The collector is attached to the back of the fire, and the complete unit can be kept in the hotel office and handed out to visitors as required.

A.C. Voltage Ratings Report.

The report on Preferred Voltage Ratings for Alternating-current Systems and Equipment, which has been under preparation by a joint committee during the last two years, has just been issued by the National Electrical Manufacturers' Association and the National Electric Light Association, both of America. Schedules of preferred voltage ratings are given for generators, motors, transformers, and general apparatus such as disconnecting switches, fuses, oil circuit breakers, &c. The Associations which issued the report feel that if these ratings are applied so far as practicable and as rapidly as conditions will permit, considerable financial benefits will result through the use of standard instead of special apparatus. The ratings are based on the principles in the report of the joint committee issued in October, 1928. Later, detailed schedules and tables of preferred voltages for various classes of apparatus were worked out for practical application, and they are included in the publication. This is the first document which contains all the preferred voltages and principles under one cover. Copies may be obtained from either association at 420, Lexington Ave., New York, N.Y. The price is 30 cents to members and 50 cents to non-members.

Railway Electrification.

A review of the position in Great Britain, with special reference to main-line conversion.

By ROGER T. SMITH, M.I.E.E.

(Extracts from a paper read before the SOCIÉTÉ FRANÇAISE DES ELECTRICIENS.)

IN March, 1920, the British Ministry of Transport set up an Advisory Committee under the chairmanship of Sir Alexander Kennedy to report on the adoption of a standard system of electric traction for the railways of Great Britain. This Committee reported in 1921 in favour of direct current, at a voltage of 1,500 at the sub-station busbars, for all new and extended electrifications. In 1927 the Ministry of Transport appointed a second Electrification of Railways Advisory Committee to review the recommendations of the previous Committee. In the meantime some 445 miles of single track had been added to existing electrified railways, 8½ per cent. being extensions of tubes, or suburban systems connected to the London underground system, and the rest belonging to the Southern Railway. All these extensions had been electrified on the direct-current system at 600/650 volts.

Under the Railway Act of 1921, 119 British railways had been formed into four groups, of which the Southern Railway had by far the largest share of electrified track. It found in the centre of its system 69 single track miles of line, forming part of the former London, Brighton and South Coast Railway, electrified on the single-phase system at 25 cycles, 6,600 volts. So inconvenient was this different system wedged in between the former London and South-Western system in the west and the former South-Eastern & Chatham system in the east that the Southern group decided to change the overhead single-phase to the third-rail direct-current system at 650 volts. This decision was taken before the Committee met.

One other fact that the Committee had to consider was that only one length of line, the mineral line between Shildon and Newport (started up in 1915) on the London & North-Eastern Railway, with a route length of 18.6 miles and a single-track length of 48.5 miles, had been electrified on the standard system at 1,500 volts direct current.

Beyond this small portion of experimental main line, all the electrified railways in Great Britain are of the suburban type. Such a passenger service has been found all over the world to be best met by multiple unit rolling stock.

The Committee was, therefore, confronted with the fact that the only railway electrifications which had taken place since the first report was issued in 1921, standardising 1,500 volts direct current, were extensions, either of existing tube railways, or of suburban railways connecting with them, or extension of lines already electrified, all using multiple unit stock, except the Metropolitan Railway, on which certain passenger and freight trains arriving steam-hauled from outside, are hauled by electric locomotives to the terminus. No extensions had been made using the standard system at 1,500 volts, and there seemed no likelihood of any immediate main-line electrification in Great Britain.

The Railway Electrification Committee which reported* in the summer of 1928 confirmed the standard of direct current at 1,500 volts, but, instead of making the lower voltage dependent on the consent of the Ministry of Transport, also standardised 750 volts, leaving 3,000 volts to be applied for. In future, extensions or new railway electrifications are to be at either 1,500 or 750 volts, but in view of the fact that by far the greater part of the existing multiple unit stock is either at 600 or 650 volts it is recommended that while electric motors should be designed to give the best results at the voltage for which they have to work, all motors in future must be capable of working at 750 or 1,500 volts. Overhead collection is standardised for 1,500 volts, with special approval by the Ministry for third-rail collection where technical, structural, or economic conditions, having due regard to safety, justify its adoption. Uninsulated return by the running rail is specified. Third rail with over-running contact-shoe collection is standardised for the lower voltage, with uninsulated return by the running rails. A fourth insulated rail for the return circuit may be permitted for tubes and for limited extensions of systems already using an insulated return.

While all the railway groups are limited to a maximum loading width of 9 ft., the maximum height differs between the groups and within the groups. Locomotives within a loading gauge 9 ft. wide and 12 ft. 8 in. maximum height can run over 19,952 route miles out of a total of 20,216 miles, that is over 98.7 per cent. of the British standard gauge railways. Locomotives wthin a loading gauge 9 ft. wide and 13 ft. 2 in. high can be worked over 13,327 route miles, that is over 67 per cent. of the total route. For all practical purposes therefore, an electric locomotive, capable of running on all the British railway services on standard gauge lines, can go anywhere structurally, so that only differing systems of electrification are a hindrance to complete interchange of electric locomotives.

Great Britain possesses coal of good quality, whose carriage accounts for about one-third of the freight revenue and one-fifth of the total revenue of our railways, and the coal trader naturally looks to the railways to use the commodity which brings them so much revenue. The use of electricity generated in power stations demands, for a given tractive power, about half the amount of coal which would be burnt in the furnaces of steam locomotives. This circumstance provides one reason why no main-line electrification in Great Britain has as yet been carried out.

RAILWAYS ELECTRIFIED IN GREAT BRITAIN AT THE END OF 1929.

—	G.W. Railway.	L.M. & S. Railway.	L. & N.E. Railway.	Southern Railway.	London Underground Railways.	Metropolitan Railway.	Mersey Railway.	Liverpool Overhead Railway.	Total.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Electrified Lines—									
Running lines—Route length ...	8.8	107.7	50.3	270	81.7	39.4	4.8	6.5	569.2
Running lines—Single track length...	17.8	225.0	110.8	710	166.9	9 .6	9.5	13.0	1349.6
Sidings—Single track length	2.5	26.0	18.1	40	44.7	16.8	2.3	13.7	164.1
Total single track length electrified...	20.3	251.0	128.9	750	211.6	113.4	11.8	26.7	1513.7
Electricity for Traction—									
Total of one hour maximum demands on power station or on supply kW	3,570	Partly estimated 40,650	Partly estimated 6,300	75,080	91,200	35,700	2,470	1,300	256,270
High-voltage electricity generated or bought kWh (1,000)	13,318	125,427	15,620	270,550	319,500	121,093	9,407	3,819	888,737
Train-miles per annum (1,000)	1,006	6,798	1,138	17,827	17,826	6,777	507	729	52,612
Ton-miles per annum	122,599,659	1,201,964,271	225,710,848	3,275,520,595	2,067,517,969	1,040,281,292	64,772,770	35,741,433	8,034,108,837
					Pence/mile.				
Average working cost per train-mile					46				
Per ton-mile					0.396				

* Report of Railway Electrification Committee (1927), Ministry of Transport, published by His Majesty's Stationery Office, London.

As already stated, the Shildon and Newport mineral line was the only piece of main-line electrification in Great Britain at the end of 1929, and the only one not having multiple unit stock. This will not be true when the electrified line between Manchester and Altrincham, jointly owned by the London, Midland and Scottish and the London and North-Eastern Railways, has been opened. This section of main line possessing 28 miles of single track will be worked for passenger service with multiple unit rolling stock. The track will be equipped with overhead contact wires worked at 1,500 volts direct current.

The Southern Railway electrification is by far the most extensive of any railway electrification in England above ground, and 710 miles of single track are now electrified on the direct current system at 650 volts and the same system will be continued right down to the coast.

One reason for this is that the unattended sub-station has reduced the cost of working at so low a voltage as 650, although the sub-stations cannot in general be more than 5.5 miles apart and may have to be half that distance.

The general conclusions with regard to unattended sub-stations, from English experience, may be stated as follows. Assuming automatic sub-stations, with only one unit of plant in each, are spaced sufficiently close together, ten such unattended sub-stations will take the place of six attended sub-stations designed to work the full service with one unit of plant out of commission.

The first cost of the unattended sub-station scheme including sub-station buildings, equipment, pilot cables and control equipment will be from 10 per cent. to 15 per cent. higher than that of the attended sub-station scheme, but the annual charges—interest, depreciation, maintenance, and operation will be about 10 per cent. in favour of the unattended sub-stations. Sub-station losses are heavier for the unattended sub-stations, but these losses are compensated for by the lower losses in the contact rail and in the track rail return, and in the extra elasticity in working due to the smaller voltage drop between sub-stations.

It is obvious that a fully automatic sub-station, worked by the voltage drop caused by the trains, cannot be worked above a certain density of traffic, and beyond that density where the remote controlled or supervisory controlled sub-station comes in, the justification for using so low a voltage as 650 for, say, the 50 miles from London to Brighton, is not only due to the saving from unattended as opposed to attended sub-stations, but also to the first cost and annual charges of the electrical equipment of the rolling stock. So much rolling stock has been equipped in England at 650 volts that this equipment has become standardised and is much cheaper than 1,500-volt equipment. As a result, at the present time, largely owing to manufacturing conditions, it is economical to electrify quite long lengths of line at 650 volts direct current in England.

The British Finance Act of 1929 removed the passenger duty which had been imposed in 1842 as a percentage on certain passenger fares and services, on condition that the greater part of the capitalised value of the passenger duty should be spent on improvements on the railways.

It is this capital which is to be used by the Southern Railway in extending its existing electrification as far as Brighton and Worthing.

The present Government passed legislation which set up a Development Act Committee to assist with public funds the carrying out of important works which would increase employment. Under that scheme the London & North-Eastern Railway is considering the electrification of 173 miles of single track northwards out of London, and the London, Midland and Scottish Railway is carrying out the electrification of the Manchester and Altrincham line referred to above.

While road transport undertakings are being bought up by railways, or working arrangements are being come to between them, it is too early to predict its effect on electrification, but as soon as the mutual working of road and rail transport in Great Britain has settled down it seems likely that the electrification of lines purely to meet road competition will cease. Until many years of experience with the combination of road transport with rail has been obtained, it is not likely that schemes of main-line electrification will have much chance of being undertaken.

On the other hand, the Government, anxious to assist schemes which would provide employment, have set up a Committee on Railway Electrification for main lines under the chairmanship of Lord Weir. If the Committee's report is favourable to electrification, both technically and financially, main-line electrification will no doubt be further considered by the railways. It is noteworthy that England carries more passengers electrically than any other country in Europe.

The paper contains data relating to electrified lines at the end of last year for each British railway. Particulars are tabulated in the form adopted for the paper read by the author before the World Power Conference in 1924.

Electricity Meter Approved.

The Electricity Commissioners have approved the Metropolitan-Vickers Type NE single-phase watt-hour meter, with rated sizes of 2½, 5, 10 and 20 A.

Scottish Electrical Contractors.

Annual Meeting and Conference.

IN our last issue we made brief reference to the recent annual general meeting of the Electrical Contractors' Association of Scotland which this year was combined with a week-end conference of members at Taymouth Castle, Perthshire.

The proceedings opened on May 30th with a luncheon, and in the afternoon the annual general meeting was held in the Castle Library, the retiring president, Mr. Johnston Foggo presiding. The report and accounts showed that the Association was in a very strong financial position. The accounts of the Association's Benevolent Fund, which was instituted two years ago, showed a substantial credit balance. As we have already reported, Mr. D. H. Morris (Dundee) was elected president. After dinner in the evening a whist drive was held for prizes presented by the Glasgow branch of the Association and this was followed by a dance.

The chief morning engagement on the following day was the annual golf match, East *v.* West, the East winning by 9½ matches to 7½ matches. From this and other competitions the Benevolent Fund derived substantial support.

In the afternoon papers were read by Mr. Morris, Mr. Foggo, and a former past-president, Mr. Alexander Lindsay. Mr. Morris dealt with "The Extension of the Organisation of the Association." He pointed out that the Association was not organised for aggressive purposes, but for the legitimate defence of the contractors' interests and also to speak and act unitedly in the councils of the industry. He drew attention to the advantages to be gained by the Association, on behalf of its members, negotiating appropriate trade agreements and he felt that in the future the manufacturers would require to do more in recognising the associated strength of the contractors' organisations in England and Scotland. Trade abuses could be much more efficiently dealt with by an Association than by individuals, and he hoped that before long a definite fair trading agreement would be come to which would place trade on a sounder basis and at the same time strengthen the position of the British manufacturer in the home market. He suggested a forward campaign for the enrolment of additional members both in the large cities and in the provinces.

In the discussion which followed, it was suggested that where branches were impossible, circles should be formed; that the Association was of as much use to the rural contractor as to the city contractor; and that public contracts and work on assisted wiring schemes should be confined to members of the Association and registered contractors.

Mr. Johnston Foggo took for his subject "How to Strengthen the E.C.A. of Scotland by Maintaining the Standard and Quality of Installation Work." He said that composition-sheathed cables were preferable to the rubber-covered type for surface wiring, but trouble was likely to arise if they were concealed under floors or in plaster. There was a danger that surface wires would be unfixed during decoration. Lead-alloy sheathed conductors suffered from similar disabilities, but had the advantage that if suitable junction and outlet boxes were used, continuity of the sheathing could be maintained throughout the installation. One disadvantage experienced, however, was from a breakdown of the v.i.r. insulation and earthing to the metal sheath.

Mr. Foggo then considered v.i.r. conductors in steel-screwed pipes, stating that other kinds of pipes were not satisfactory. He maintained that such an installation when carried out by experienced tradesmen and with generous supplies of boxes available need not be prohibitive in cost, and its advantages far outweighed the weaknesses of the other systems. If a specification for a screwed steel conduit system of wiring, such as he had outlined, was formulated, to which members of the Association would estimate, it would, he felt sure, be for their good and strengthen the Association.

Mr. Alexander Lindsay dealt with "The Scheme for the Registration of Electrical Contractors." He explained the objects of the Register and showed how the registration authority was representative of every branch of the industry. He explained in detail the qualifications required for registration and submitted that it was only by registration that the difficulty of the irresponsible contractors could be dealt with. He urged every member to become a registered contractor. In the ensuing discussion which followed, strong support was expressed for the scheme by many, while others expressed the view that the voluntary character of the scheme was its greatest defect.

Business meetings and conferences did not take up the whole time of the representatives present at the Conference and time was found for a magnificent motor car drive round Loch Rannoch and the opportunity was taken to visit the new hydro-electric station on the shores of the Loch. The Conference disbanded on June 2nd.

The Chilean Market.

A Review by the Commercial Secretary at Santiago.

Mr. E. Murray Harvey, O.B.E., Commercial Secretary at Santiago, has prepared for the Department of Overseas Trade a report upon conditions in Chile, dated November, 1929.* As usual, this is prefaced by a commercial summary containing useful general information. From this it is gathered that Chile has an area of about 290,000 sq. miles and in 1927 the population was estimated at 4,000,000. Under the new monetary law the par value of the peso is 6d.

The introductory chapters note the continuance of the improvement reported two years ago; the dispute with Peru regarding Tacna-Arica has been settled, and the country's finances have been placed on a sounder basis. Chile's foreign trade in 1928 amounted to over £79,000,000, the highest figure reached since the abnormal year 1920, and there was a favourable balance of nearly £20,000,000. The value of British trade with Chile was greater in 1928 but the proportion (18 per cent.) remained about the same. The United States trade was in a similar position although its share was much larger than Great Britain's. The imports from Germany rose from 13 to 14 per cent. Among the commodities, the importation of which has shown a marked increase, are boilers and power units, insulated cables, electric lamps, telegraph material, radio apparatus, batteries and other electrical goods.

Mention is made of the acquisition of large public utility undertakings, such as electric light and power, tramway and telephone services, by American concerns, and it is stated that close co-operation between financial and trading interests has greatly assisted American commerce to gain the enviable position that it now holds in the Chilean market.

Electrical Import Trade.

There is a good demand in Chile for electrical material of all kinds, but the import figures have fluctuated a little during the past six years owing probably to the incidence or absence of large contracts in particular years. In 1928 electrical imports had a value of £962,000, divided as follows:—United States 39 per cent., Germany 26 per cent., United Kingdom 25 per cent., other countries 10 per cent. The corresponding total for 1927 was £791,000, of which the United States supplied 50 per cent., and Germany and the United Kingdom 22 per cent. each. Details of the Chilean electrical imports during 1927 and 1928 were published in our issue of February 14th last but one or two items deserve comment. The United Kingdom did well in a number of directions; for instance, 71 per cent. of the insulated cable imports were credited to this country in 1928 (against 33 per cent. in 1927), and we were also responsible for 50 per cent. of the telephone apparatus (62 per cent. in 1927). Considerable advances were made in the following items:—Radio apparatus, from 9 to 40 per cent.; dynamos and electric motors, from 7 to 24 per cent.; and batteries, from 8 to 30 per cent. In addition to the United States and Germany, the following countries are competitors in the Chilean electrical market:—Holland (lamps and insulated wire); Austria (lamps); Belgium (lamps, telephone apparatus and insulated wire); France (lamps and radio apparatus); and Switzerland (telephone, telegraph and radio apparatus).

The purchase by an American group of the large tramway, electric lighting, &c., undertakings of Santiago and Valparaiso from British companies during 1928 is expected to influence the placing of orders for equipment. Much of the old tramway rolling stock in use in the capital is of German origin, but the newest cars in use have been imported from the United States.

Notes on the Market.

Mr. Harvey says that the high quality of British manu factures is well known and appreciated in Chile; but the Chilean market is now one in which cheapness, advertisement, and, in many cases, ample credit have more weight than quality. Competition is ever-increasing, and while British firms are beginning to advertise more than they did formerly they should, in the opinion of the writer, provide still larger sums for advertising, for the expenses of visiting agents and for similar purposes than they do at present. Undoubtedly, the best way in which to enter the market is for the manufacturer or exporter to send a representative, having the necessary technical and commercial experience and, if possible, a knowledge of Spanish, to investigate possibilities on the spot, appoint agents, arrange the necessary advertising, and generally study local preferences. This method, although costly, is better than to attempt to appoint agents by correspondence. There has lately been a tendency for manufacturers to establish their own selling organisations in the country but the smallness of the market precludes this in the case of most manufacturers. It has been suggested that the creation by a British group of manufacturers of an export sales corporation, with headquarters in London and branch offices, with sub-agencies, in Latin-American countries, might prove successful and by co-ordinating effort save expense.

* Stationery Office. 3s. net.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Research and Electricity Supply.

A recent article in your paper on "Research and Electricity Supply" refers to "voicing" the requirements of the "demand" section of industry.

Indeed it is high time that some such organisation, common to all sections of the industry, was formed, and what is more, the personnel should be men who know what is wanted and how to get it.

It would appear to me that the men engaged on this class of work should have a good knowledge of the industry obtained by personal contact therewith, coupled with sound technical qualifications.

As no doubt development in such an organisation will lead to a demand for "highly technical" and trained assistants, drawn from our existing works, supply companies' laboratories, and the colleges, it is to be hoped that those responsible for the schedule of salaries to be paid to such men will take into consideration the old proverb that "the labourer is worthy of his hire."

In my humble opinion the expenses incurred by the bulk of technical workers in connection with their work is often not taken into consideration when fixing the scale of salaries; hence the dearth of the right type of man.

A.M.I.E.E.

June 12th, 1930.

The Shannon Scheme.

I rather pride myself on keeping up-to-date in all matters connected with the Shannon development, but I must confess that your correspondent "P.T.W." seems to be in touch with sources of information which hitherto have been denied to me. I congratulate him upon his success in getting behind the fog which he says always "has shrouded all data and statistics relating to the Shannon scheme."

As an earnest student of electro-economics, and as a person who hopes that he has an open mind with respect to the electrification of the Irish Free State and of Northern Ireland, I would ask "P.T.W." to let me know through your columns the sources of the information on which he based the statements in his letter to you.

Those statements may be condensed, I think, as follows:—

(*a*) The construction costs of the Shannon scheme are three times greater than the original estimate.

(*b*) The selling price to the consumer is more than three times greater than the original estimate.

(*c*) That the Northern Government wishes to compete with the Free State in the supply of electricity.

Robert N. Tweedy.

Dublin, *June 10th*, 1930.

Electric Bells.

Information is required as to whether an electric bell is made similar to the "Whittington," but with a slower movement; in fact we want a bell with tone and *movement* as much like those of old-fashioned crank bell as possible. We have tried a number of makers, but have not been able to find quite the thing we want. Personally, we do not think there is such a thing on the market, but we want to assure our customer that we have done our best.

Bell.

June 11th, 1930.

Value for Service.

Mr. A. E. McKenzie, chief engineer of the Wimbledon electricity undertaking, in his remarks on domestic water heating at the recent I.M.E.A. Convention at Eastbourne used a phrase which might well be adopted as the slogan of the electrical industry.

He pointed out that in discussing the matter with consumers, it was unnecessary to dwell on whether the actual cost was more or less than that of other forms of heating, but rather on the definite fact that consumers obtained good value for their money and value for service, which seems to be the correct way of looking at the matter in all branches of the industry, whether illumination, power, or heating.

There is an economic price per kWh for all uses, this price being that which consumers are content to pay; if thousands are satisfied with electric light at 6d. to 9d., electric cooking and water heating from ½d. to 1d. or even 1½d., these figures clearly indicate a commercial proposition. If therefore we now advance further and note that a considerable number of business houses, hospitals, &c., are fitting electrical central heating plants with steam and hot water on a large scale with rates of 0.3d. to 0.5d. we again have an actual fact.

Is it not therefore better to interest consumers in the way suggested by Mr. McKenzie rather than allow estimated figures

based on all sorts of theory to be quoted against electricity instead of figures based on actual facts? Each job has always to be considered on its merits and, generally speaking, electricity properly handled will do the job best, and together with a fair price per kWh will give value for service and satisfaction to the consumer.

Bastian Meter Company, Ltd.,

F. J. C. ALLEN.

Slough, *June*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

33,921. "Electric regulating and controlling devices." Akt. Ges. Brown, Boveri et Cie. March 3rd, 1928. (307,046.)

34,058. "Arrangement for increasing the efficiency of long-distance electric conductors." Siemens-Schuckertwerke Akt. Ges. August 27th, 1928. (318,095.)

34,190. "Fusible electric cut-outs." C. E. Cruttwell. November 21st, 1928. (Cognate application, 24,861/29.) (329,638.)

37,204. "Electric furnaces." R. Schmitz. December 16th, 1927. (302,594.)

37,382. "Luminous electric discharge tubes." A. E. Chapman and J. Vielle. December 18th, 1928. (329,639.)

37,684. "Arrangement of parallel co-operating magnets." L. Mellersh-Jackson (Siemens & Halske Akt. Ges.). December 20th, 1928. (329,621.)

37,782. "Protecting devices for electric distribution systems." International General Electric Co., Inc. December 28th, 1927. (303,112.)

37,921. "Electrical protective devices." General Electric Co., Ltd., and W. Wilson. December 22nd, 1928. (329,660.)

1929.

1,439. "Magnetos." L. Mellersh-Jackson (F. I. Gibson and G. S. Hayward). January 15th, 1929. (329,640.)

2,191. "Relays for distant control." A. Strahm, C. Strahm, A. Quinche, A. Strahm, B. Quinche, B. Strahm, G. Strahm, and C. Lipmann. January 25th, 1928. (304,726.)

2,499. "Volume-control devices or systems for radio-receiving apparatus." A. Hall and Ferranti, Ltd. January 24th, 1929. (329,689.)

4,960. "Semi-automatic telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky and O. C. From). February 14th, 1929. (329,626.)

5,148. "Means for stopping trains independently of drivers." Allgemeine Elektricitäts Ges. February 15th, 1928. (306,101.)

5,149. "Current-impulse producing device, particularly for use on railways." Allgemeine Elektricitäts Ges. February 15th, 1928. (306,102.)

5,277. "Metallic-vapour and gaseous arc-discharge devices." P. Freedman. February 16th, 1929. (Cognate application, 38,475/29.) (329,627.)

5,293. "Generation of electric oscillations." Compagnie des Lampes. June 8th, 1928. (313,143.)

5,373. "Telegraphic installations." Siemens & Halske Akt. Ges. February 18th, 1928. (306,406.)

5,414. "Circuits for discharge tubes." C. J. R. H. von Wedel. February 17th, 1928. (306,413.)

5,549. "Television apparatus and the like." J. L. Baird and Television, Ltd. February 19th, 1929. (329,664.)

5,587. "Electric time switches." Horstmann Gear Co., Ltd., and A. Horstmann. February 20th, 1929. (329,633.)

5,620. "Oil-jacketed insulators for electric switchgear and the like." A. Reyrolle & Co., Ltd., and J. Christie. February 20th, 1929. (329,635.)

5,673. "Electric irons." Siemens-Elektrowärme Ges. February 28th, 1928. (306,952.)

5,679. "Electrical picture receivers and the like." R. F. Collinson. February 20th, 1929. (Cognate applications, 7,929/29 and 7,932/29.) (329,637.)

5,685. "Means for increasing the resistance of discharge tubes to through sparking." Dr. W. Germershausen. May 12th, 1928. (Addition to 306,034.) (311,396.)

5,735. "Dynamo-electric apparatus for the regulation and control of electric currents and machinery." J. F. Gill and J. N. Chaviara. February 21st, 1929. (Cognate application, 6,863/29.) (329,651.)

5,746. "Carrier telegraph alarm system." Standard Telephones and Cables, Ltd. March 6th, 1928. (307,395.)

5,770. "Braking of electrically-propelled rail vehicles." A. W. Maley and E. M. Taunton. February 21st, 1929. (329,668.)

5,803. "Electric transformers." F. S. Smith. February 21st, 1929. (329,669.)

5,940. "Electric switches or indicating devices." General Electric Co., Ltd., and A. E. Angold. February 22nd, 1929. (329,678.)

6,014. "Insulating materials." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). February 23rd, 1929. (329,683.)

6,051. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. February 23rd, 1929. (329,684.)

6,087. "Electric discharge tubes with rare gas fillings." A. Lederer. February 24th, 1928. (306,831.)

6,133. "Continuous loading for signalling conductors." Standard Telephones and Cables, Ltd., G. Lawton, and W. H. Dearden. February 25th, 1929. (329,700.)

6,158. "Telegraph instruments." J. A. Smale. February 25th, 1929. (329,701.)

6,170. "Method for the transmission of wireless-telephony by means of sound records." C. Stille. February 25th, 1929. (329,702.)

6,171. "Combined electromagnetic talking-machine and wireless receiving apparatus." C. Stille. February 25th, 1929. (329,703.)

6,300. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and F. H. Harris. February 26th, 1929. (329,710.)

6,329. "Electric toaster." G. Eaton. February 26th, 1929. (329,711.)

6,353. "Conductor rail of increased electrical conductivity." C. R. Altenheim (K. Spieckermann). February 26th, 1929. (329,717.)

6,870. "Photo-electric cells." Associated Electrical Industries, Ltd. March 3rd, 1928.) (307,082.)

7,357. "Rubber-covered electric cables." Siemens-Schuckertwerke Akt. Ges. June 28th, 1928. (Addition to 307,429.) (314,485.)

7,378. "Alternating-current metallic-vapour lamps." Silectra Ges., H. Geffcken, and H. Richter. March 6th, 1929. (329,730.)

7,641. "Dry metal rectifier cells." Siemens-Schuckertwerke Akt. Ges. March 21st, 1928. (308,306.)

7,647. "Domestic electric installations." L. Mellersh-Jackson (Siemens-Schuckertwerke Akt. Ges.). March 8th, 1929. (329,734.)

7,751. "Control and voltage regulating means for electrical transforming devices." General Electric Co., Ltd., and A. E. Angold. March 9th, 1929. (329,736.)

8,107. "Laminated structures for dynamo-electric machines." E. Barlow and Associated Electrical Industries, Ltd. March 12th, 1929. (329,739.)

8,470. "Arrangement for the successive connection of one of several testing circuits with a distant testing point by means of two synchronously-driven selector switches." Siemens & Halske Akt. Ges. March 16th, 1928. (307,932.)

8,827. "Electric puncture alarm for pneumatic tires." D. McIntosh. March 19th, 1929. (329,746.)

8,949. "Thermionic or like amplifiers." P. G. A. H. Voigt. March 20th, 1929. (329,747.)

9,341. "Röntgen tube having its anti-cathode movable relatively to the cathode." E. Pohl. March 31st, 1928. (Addition to 293,318.) (308,800.)

9,974. "Maximum-demand indicators for electric current." J. E. Speight and Record Electrical Co., Ltd. March 28th, 1929. (329,760.)

10,925. "Electric testing appliances." J. H. Runbaken. April 9th, 1929. (329,774.)

10,934. "Method of, and apparatus for, the transmission of signals by telegraphonic means." C. Stille. October 20th, 1928. (329,775.)

10,983. "Electric operation of railway points for the shunting of railway wagons." Vereinigte Eisenbahn-Signal-Werke Ges. June 8th, 1928. (313,147.)

11,740. "Electrically-released roller and similar window shutters and the like." H. N. Soper. April 16th, 1929. (329,782.)

11,787. "Telephone systems." Telefonaktiebolaget. L. M. Ericsson. April 21st, 1928. (310,038.)

11,950. "Submarine cables." Siemens-Schuckertwerke Akt. Ges. May 1st, 1928. (310,843.)

12,074. "Methods of recording sound in association with picture films and apparatus therefor." Western Electric Co., Ltd. (Electrical Research Products, Inc.). April 18th, 1929. (329,785.)

12,665. "Electric ceiling roses." R. Nettl. April 24th, 1929. (329,791.)

13,113. "Electron-discharge devices." Cleartron (1927), Ltd., and J. R. Sinclair. April 27th, 1929. (329,802.)

13,510. "Electromagnetically-controlled door bolts for bath rooms." J. Goddard. May 1st, 1929. (329,808.)

13,706. "Electric insulating material." International General Electric Co., Inc. May 2nd, 1928. (310,894.)

15,142. "Electric furnace." H. G. Campbell. May 15th, 1929. (329,830.)

15,244. "Galvanic batteries." Oldham & Son, Ltd., and W. D. Wilde. May 15th, 1929. (329,831.)

15,639. "Wireless receiving apparatus." T. A. Biddington and R. Field. May 18th, 1929. (329,841.)

15,832. "Inductor relays." Associated Electrical Industries, Ltd. May 22nd, 1928. (312,239.)

16,588. "Apparatus suitable for use in the transmission and reception of pictures." British Thomson-Houston Co., Ltd. May 29th, 1928. (312,653.)

16,593. "Electron-discharge tubes or thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 15th, 1928. (329,854.)

18,520. "Indicating devices with two electrically-operated signals." K. F. T. Oppegaard. June 15th, 1928. (313,630.)

19,534. "Electric fire or radiator." H. H. Berry. June 25th, 1929. (329,876.)

20,724. "Photo-electric cells." Vereinigte Gluhlampen und Electricitäts Akt. Ges. January 2nd, 1929. (329,887.)

20,911. "Pasting of grid strips for the manufacture of accumulator plates." Friemann & Wolf Ges. March 16th, 1929. (329,889.)

24,096. "Electric motor." W. Fairweather (Singer Manufacturing Co.). August 7th, 1929. (329,905.)

24,235. "Electric motor." W. Fairweather (Singer Manufacturing Co.). August 8th, 1929. (329,907.)

24,602. "Circuit arrangements for connecting an aerial or other load to a high-frequency source." Telefunken Ges. für Drahtlose Telegraphie. August 11th, 1928. (317,297.)

25,118. "Radio direction finding." Telefunken Ges. für Drahtlose Telegraphie. August 23rd, 1928. (317,826.)

31,355. "Arrangement for igniting a mercury-vapour arc." Maschinenfabrik Oerlikon. October 29th, 1928. (329,942.)

32,677. "Electric rectifier apparatus." British Thomson-Houston Co., Ltd. October 27th, 1928. (329,945.)

1930.

8,975. "Arrangement for increasing the efficiency of high-potential long-distance lines." Siemens-Schuckertwerke Akt. Ges. August 27th, 1928. (Divided application on 318,095.) (329,658.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 11th :—

F.S. & Co. (lettering and Thistle design). No. 505,295. Class 5. Bronze and copper wire.—London Electric Wire Co. and Smiths, Ltd., 7, Playhouse Yard, Golden Lane, E.C.1.

Ipso. No. 509,337. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Die Elektrotechnische Fabrik Alfred Baehr Gesellschaft, Berlin. (British representative: D. Grabow, 19, Minster Road, N.W.2.)

Porcupine (lettering and design). No. 512,531. Class 8. Electric cables.—Enfield Cable Works, Ltd., 286-302, High Holborn, W.C.1.

E. M. Ginn (lettering and design). No. 512,681. Class 8. Sound-reproducing apparatus.—E. M. Ginn, Ingerthorpe, Great North Road, Highgate, N.6.

Ace. No. 512,290. Class 13. Electric lamps (ordinary).—Electric Lamp Service Co., Ltd., 39-40, Parker Street, Kingsway, W.C.2.

Durez (lettering and design). No. 506,871. Class 50. Synthetic resins and moulding composition, products of phenol and formaldehyde.—General Plastics, Inc., North Tonawanda, N.Y., U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Canadian Hydro-electric Developments.

The completion of a gigantic dam on the Gatineau River, Quebec, bringing the amount of water available at all times up to 145 thousand million cub. ft., nearly twice the capacity of the famous Assuan dam on the Nile, is announced in the first year's report issued by the International Hydro-Electric System, the power combine controlled by the International Paper & Power Company.

This remarkable feat of engineering, which was planned to guard against the adverse effects of dry seasons, will, it is claimed, ensure sufficient water power to keep the combine's Gatineau River plant working at full capacity eight hours every working day if no rain were to fall for a year. The International Hydro-Electric System, which operates both in Canada and the United States, has now a total installed capacity of 1,300,000 h.p., of which 852,000 h.p. is obtained from water power. As part of its scheme to electrify industrial Canada, it is stated, a 132,000-volt transmission line, 104 miles long, has been installed to connect the Grand Falls hydro-electric plant on the Saint John River with a new mill of the International Paper & Power Co., at Dalhousie.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERGAVENNY.—Houses (44) for the T.C. (£15,516); J. G. Thomas & Sons, contractors.

ASHTON-UNDER-LYNE.—Houses (178) for the T.C.; J. Rowbottom, borough surveyor (returnable deposit of £2 2s.).

BILSTON.—Houses (394) for the U.D.C.; surveyor.

BLACKBURN.—Branch libraries, Mill Hill and Whalley New Road; borough surveyor.

BOSTON.—Houses (112) for the T.C.; J. H. Metcalf Bros., builders. Employment exchange for H.M. Office of Works, King Charles Street, London, S.W.

BURY.—Flats (420), Springs; borough engineer.

CARLISLE.—Development, Brampton Estate, for J. Holiday; H. E. Scarborough, architect.

CHELMSFORD.—Houses for the T.C.; F. J. & A. A. Lowe, Writtle (64), and Pryke & Son (60), builders.

CONSETT.—Houses (64) for the U.D.C.; J. J. Eltringham, architect.

CROYDON.—Houses (52), Mitcham Road estate, for the T.C.; borough engineer (returnable deposit of £3 3s.).

DARTFORD.—Development Dowlands estate, The Brent; L. Fuller. Houses (34), Whitehall estate; W. J. Brise.

DERBY.—Public baths, Queen Street, for the T.C.; borough surveyor.

DUNDEE.—Two R.C. schools; executive officer to the Education Authority.

DUNOON.—Additions to Grammar School (£9,000); headmaster.

ECCLES.—Fire station and houses (9) for the T.C. (£17,742).

FARNHAM (Surrey).—Houses (78), Ash, for the R.D.C.; A. J. Stedman, architect.

FELLING.—Public library; surveyor to U.D.C.

GAINSBOROUGH.—Bazaar premises, Silver Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

GILLINGHAM (Kent).—Houses (66), Rainham, for the T.C.; borough surveyor.

GOLBORNE.—Houses (54) for the U.D.C.; surveyor.

HARROGATE.—Conversion of Victoria Baths into municipal offices; C. E. Rivers, borough engineer.

HECKMONDWIKE.—'Bus garage for the Yorkshire (Woollen District) Electric Tramways, Ltd.; general manager, Savile Town, Dewsbury.

HEMEL HEMPSTEAD.—School, Durrants Hill (£26,850), for the borough E.C.; director of education.

HULL.—Telephone exchange, Heedon; J. H. Fenwick & Son, builders.

HYDE.—Extensions, infectious diseases hospital; borough engineer.

IRISH FREE STATE (Dublin).—Reconstruction of Princes Street section of the G.P.O. for the Board of Works; T. Cassedy, secretary to Board of Public Works (returnable deposit £5).

(Rathmines, Dublin).—Blocks of flats, Hollyfields site and Plunkett's area; F. G. Hicks, architect, Town Hall (returnable deposit of £3 3s.).

KENDAL.—Cinema theatre, Sandes Avenue; J. Stables, architect, Bank Chambers, Ambleside.

KETTERING.—Extensions, General Hospital; Gotch and Saunders, architects.

KINGSTON-ON-THAMES.—Houses (140), Norbiton, for T.C. (£47,616); Wych Elm Estate Co., Ltd., contractors.

KNOTTINGLEY.—Pumping station at sewage works; G. J. Laverick, engineer and surveyor to U.D.C. (deposit £1 1s.).

LANCS.—Practical instruction centre, Tottington, for the Lancs. C.C.; Thomas Kenny & Sons, builders, James Street, Bury.

LEEDS.—Development, Cookridge estate, Green Lane; Rea and Co. Development, Moor Grange estate; W. Ratcliffe & Co. Extensions, Osmondthorpe school (£29,000); city architect.

LEICESTER.—Sanatorium and isolation hospital, Markfield, for the Isolation Hospitals Committee; MacCarthy, Collings & Co., architects, Coalville (returnable deposit of £5 5s.).

LEWES.—Factory, Friars' Walk, for Wightman & Co., Ltd.

LEYLAND.—Sewage disposal works (£30,000); surveyor to U.D.C.

LIVERPOOL.—Houses (77), Fazakerley Hall estate; director of housing, Municipal Buildings, Dale Street.

LONDON (Blackfriars, E.C.).—Reconstruction, Lever House; Sir John Burnet & Partners, architects.

(Edmonton, N.).—Factory for Associated Box Co., Ltd., Sandell Road; George Newman, architect.

(Sydenham, S.E.).—Estate development between Kent House Lane and Kangley Bridge Road; A. J. Bawcutt.

LONG SUTTON (Lincs.).—Bank, Barclay's Bank Co., Ltd., London.

MANCHESTER.—Extension of head offices, Whitworth Street; Refuge Assurance Co., Ltd.

MILNROW.—Houses (112) Firgrove site; A. Travis, architect, Union Bank Chambers, King Street, Rochdale (deposit £2 2s.).

NORTH RIDING.—Technical school, Eston, for the North Riding E.C.; county architect, County Hall, Northallerton.

NEWCASTLE-ON-TYNE.—Houses (350), Walker estate; city engineer. 'Bus garage, Portland Park, Jesmond Road, for United Automobile Services, Ltd.; A. & J. Main, steelwork contractors, Glasgow. Ice skating rink; P. L. Browne & Son, architects.

PAISLEY.—Alterations to Palladium Picture House; manager.

PETERBOROUGH.—School, West Town, for the City E.C. (£9,000); director of education.

RADCLIFFE (Lancs.).—Senior school, clinic, &c. (£58,000) for the E.C.; director of education.

RAMSBOTTOM.—Bank, Longsight Road; District Bank, Ltd. Weaving shed; Chatterton Weaving Co.

RAMSGATE.—Reconstruction King's Theatre; Everard Healey, architect.

READING.—Housing scheme, Whitley estate; J. S. Paton, architect.

SALISBURY.—Cinema theatre, The Canal, for the British Gaumont Co.

SAWBRIDGEWORTH.—Electric lighting installation, Council offices, for the U.D.C.; surveyor.

SCUNTHORPE.—Elementary school (£23,500); H. G. Gamble, architect.

SMETHWICK.—Extensions, Hume Road works; Smethwick Telephone Co., Ltd.

SOLIHULL.—Petty sessional court for Warwickshire C.C.; county architect, Leamington Spa.

SOUTHGATE.—Cinema, High Road; Robert Crombie, architect.

SOUTHWICK (Sussex).—Houses (56), The Gardens, for G. Coomber.

STOKE-ON-TRENT.—Development, Holly Bank estate; E. Kinson.

TONBRIDGE.—Extensions, St. Andrew's School (£24,000); Campbell Jones, Son & Smithers, architects.

TRENTHAM (Staffs.).—Houses (75) on estate near Mon Abri; T. Horwill & Co.

TWICKENHAM.—Houses (125), Alton Gardens estate; A. Pascall & Son, Ltd. Houses (72), Leeson estate, for T.C. (£32,588); E. Clarke & Sons, contractors. Houses (40), Station Way; C. Grellier & Son, architects.

WALLASEY.—Houses (92) for the T.C.; Joseph Davies, builder, Birkenhead.

WATFORD.—Development, Bradshaw estate; Fayers and Fayers. Development, Dellfield estate; Watford Ideal Homes, Ltd.

WEST HARTLEPOOL.—Houses (36) for the T.C.; Harland and Parker, builders.

WEST RIDING.—Schools, Boroughbridge, Slead Hall and Preston, for the West Riding E.C.; H. Wormald, architect, County Hall, Wakefield.

WEST STANLEY.—Kinema; Currey & Forster, architects.

WHITBY.—Elementary school (£12,000); A. Anstead Browne, architect.

WILTS.—Schools and extensions (£236,550) for the E.C.; director of education, Trowbridge.

WINCHESTER.—Houses (132) for the T.C.; Punter and Le Clerq, builders, Farnham.